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水波時頻分析之優化（4／4）－ Asyst 與 Mathematica 程式集

交 通 部 運 輸 研 究 所

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Asyst、Mathematica、WinEdt、Workbench、仔波轉換、希伯轉換、類仔波、共關頻振、蓋博解析訊號法、瞬間頻率

摘要：

此處由一些訊號分析理論源頭出發，以 Asyst 程式語言，撰寫諸多水波數據處理分析程式。其主要分析學理類別有; 仔波轉換，希伯轉換，富立葉轉換，越零位統計法，暨相關延伸技法，如類仔波、共關頻振、解析訊號、瞬間頻率、等。此外亦開發試驗室訊號集錄及即時分析與視覺化展示之系統。除了主要使用 Asyst 語言外，亦撰寫各類輔助或應用程式碼，相關者如; Mathematica 程式，Postfix 程式，WinEdt 巨集程式，LaTeX 程式及套件，報表程式介面，資料、圖表、文件處理系統等。再者，開發建置一個功能完善、方便使用的整合工作平台亦為本研究的核心工作。

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ABSTRACT:

Various Asyst programs and add-in routines for several methodologies of water wave data analysis are developed from the ground-up. Emphasis is on the underpinning of their theoretical backgrounds and the integration among programs. The different modalities mainly involve: the wavelet transform; the Hilbert transform; the Fourier transform; the zero-up crossing statistics; as well as relevant extensions or topics, such as wavelet variant, wave coherence, analytic signal and the instantaneous frequency, etc. A laboratory system for data acquisition and preliminary real-time analysis and visualization is also developed. In addition to the Asyst language, extensive programming add-ins and application auxiliaries are incorporated or intertwined. Notably, the Mathematica language, the Postfix language, the WinEdt macro language, LaTeX codes and packages, different spreadsheet interfaces, programs for figure and document manipulations, etc. For the fulfillment of these perplexed tasks the development of a powerful and user-friendly workbench is also the main chore of the present study.

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摘要

此處由一些訊號分析理論源頭出發，以 Asyst 程式語言，撰寫諸多水波數據處理分析程式。其主要分析學理類別有；仔波轉換，希伯轉換，富立葉轉換，越零位統計法，暨相關延伸技法，如類仔波、共關頻振、解析訊號、瞬間頻率、等。此外亦開發試驗室訊號集錄及即時分析與視覺化展示之系統。除了主要使用 Asyst 語言外，亦撰寫各類輔助或應用程式碼，相關者如； Mathematica 程式，Postfix 程式，WinEdt 巨集程式，LaTeX程式及套件，報表程式介面，資料、圖表、文件處理系統等。再者，開發建置一個功能完善、方便使用的整合工作平台亦爲本研究的核心工作。

ABSTRACT

Various Asyst programs and add-in routines for several methodologies of water wave data analysis are developed from the ground-up. Emphasis is on the underpinning of their theoretical backgrounds and the integration among programs. The different modalities mainly involve: the wavelet transform; the Hilbert transform; the Fourier transform; the zero-up crossing statistics; as well as relevant extensions or topics, such as wavelet variant, wave coherence, analytic signal and the instantaneous frequency, etc. A laboratory system for data acquisition and preliminary real-time analysis and visualization is also developed. In addition to the Asyst language, extensive programming add-ins and application auxiliaries are incorporated or intertwined. Notably, the Mathematica language, the Postfix language, the WinEdt macro language, LaTeX codes and packages, different spreadsheet interfaces, programs for figure and document manipulations, etc. For the fulfillment of these perplexed tasks the development of a powerful and user-friendly workbench is also the main chore of the present study.

第 1 章

前言與研究背景

1.1 引言

資料分析一般牽涉二個層面，其一是數學理論基楚，其二是數據使用與表述。理論的根源涉及不同分析函基的使用，這方面的基本要求是對函基的解析特質有所認知與掌握；而數據資料的解說與表述一般來自試驗或觀測，這方面的要求則是建立在資料使用者對資料的完善性與信心度如何。通常要將這兩個層面整合，展現取精用宏、具體而微、功效卓著的境界，則必須靠電腦程式之運用，對軟硬體均有熟悉。

對一般工程師及大多數研究人員而言，應用是最直接的目的或圭臬。而隨著市場上許多現成的應用程式或套裝分析軟體之垂手可得，時至今日，享用現成靡然成風，願意或有能力寫程式的工程師或學者可說是鳳毛麟角，而實際上去比較深入瞭解或涉略理論解析本質的，似乎也是越來越少。現時產生的情境是，使用者對其所取用工具到底是否適切、分析是否有歸納性、結果是否有可重覆性、等等，都不甚能說定。

就作者本身的經驗暨體會而言，了解一個理論的來龍去脈，知悉其一些解析特質，所需投入的時程與精神，往往是遠遠比不上將理論化爲程式碼所耗費的時間與心力。另其折磨度、賣肝度也大爲不同。然而程式是理論的昇華，也是理論的實踐暨檢核。理論立其眞，程式表其善，兩者形乎至美。再者，程式開發、數據分析過程中屢屢會有進一步體會及不期發現，甚至於產出誤打誤撞的新結果。

1.2 分析學理暨程式與工作平台開發

此處所用主要程式語言是爲ASYST，幾乎所有學理分析、數據處理、結果呈現、圖表制作都與其有直接關聯。我們避免使用現成應用軟體，由數學源頭起，根本化的開發各類分析程式。其主要分析學理類別有;

- 仔波轉換（wavelet transform），
- 希伯轉換（Hilbert transform），
- 富立葉轉換（Fourier transform），
- 越零位統計法（significant wave），
- 相關延伸技法，如蓋博解析訊號法（Gabor's analytic signal procedure）、類仔波（wavelet variant）、共關頻振、瞬間頻率、等。

此外亦開發試驗室訊號集錄及即時分析與視覺化展示之系統。再者，建置一個功能完善、方便使用的整合工作平台亦爲本研究開發工作的核心。

除了分析上的主力語言使用 Asyst 外，亦撰寫、整合、開發各類應用或輔助程式碼。一方面追求各程式之功能性、可塑性、多元性、親和性、診誤性等，另一方面要求流程之零干擾、零人爲誤差。所念茲在茲的是：所有解析結果與絕大多數數據、圖表顯示均由程式直接自動化呈現，數據流轉不經人手。即非自動化的輸入要最少，人爲中間過程消失，註記自動而完備，由輸入至輸出一貫自動。而配合這些要求，亦必須整合一些附件程式，加入了一些不同程式語言之使用。相關者如：

- Postfix 程式語言— 此一語言之主要功能是高品質 EPS （encapsulated post-script）數據分析圖之自動化制作。經由這一整合，由原始資料以迄最終圖示可以完全自動化、一以貫之。這一功能的幫助可謂極其重大，特別是在檢驗參數衆多、嘗試條件紛紜、組合牽涉多元、類屬廣泛龐雜、數據量大類多、調適變動無窮、等等。因這些性狀下無不涉有巨量圖表之顯示及診斷判別，需要有完全系統化、無誤化制作手法。

- 即時化 PCX 圖形顯示— 數據分析結果於螢幕上之即時化 PCX 圖形顯示。前述之 EPS 分析圖主要提供非常高品質之紙張列印輸出，其雖亦可於螢幕上顯示，但其即時性、整合性、自動化性較差。而PCX 圖形以螢幕即時化成果呈現爲目的， EPS 與 PCX 兩者形成一套互補的完密系統，前者在背景下產生，而後者則在前景即時產生，同步完成。此一功能讓診誤的效益大大提升，對於撰寫複雜而及巨大的程式可說完全必要，也大大改善了程式之維護性、互動性、及彈適性、親和性、等。

- 報表 spreadsheet 介面之整合— 前述 EPS 與 PCX 爲圖示功能，若有數據資料需要輸出至工作報表，或再從工作報表輸入一些數據時，亦或數據流轉，這一整合即可發揮其功能，比如中間數據再利用、複雜數據分析結果比較、繪製一些綜合數據、或單一性圖形制作、或特殊狀況非重覆性處理、等。

- Mathematica 程式語言— 此處亦用 Mathematica 程式語言撰寫二維時頻相位分佈圖（phase plane）之呈現，此乃離散與連續仔波轉換之 ASYST 分析結果，直接傳入 Mathematica 程式中，形成數據流轉連貫自動化之分析與圖示流程。

- WinEdt 巨集程式語言— 爲提供優良的程式撰寫開發環境，運作遠超過成千上萬行大量的主程式、子程式、輔助程式，此處應用 WinEdt 巨集語言開發一工作平台，除供撰寫 ASYST 等等程式之用外，亦供各種瑣碎作業。缺少了這一工作平台，那開發工作必然是極端痛苦，也恐是椽木求魚。一套整合程式系統其所涉細節可說治絲愈紊，如其可變性、排誤性、一致性、相容性、組織性、多元性、互動性、自動性、系統性、宜人性、管理性、等等、所在多有，良好工作平台是爲必需。

- LaTeX語言及相關程式集— LaTeX語言及相關程式集除了用以書撰此一報告外，爲了科學化、效率化、宜人而正確地將難以數計的圖、表、檔案、文件等整理展示，此處亦撰寫及整合大量的 WinEdt、LaTeX、諸多外加套集或應用圖形處理程式等。這些程式一方面幫助數據分析結果之診斷、研判，一方

面爲龐雜研究案例、繁瑣系統之管理所必備。另外亦開發及加强這些程式之中文化功能。❖

第2章

離散仔波轉換

2.1 仔波類屬

此處所含蓋之仔波類屬是爲萊斯函基（Riesz bases）範疇，基本上可以分類爲四大類屬：正交類屬（orthonormal, ON）、半正交類屬（semi-orthogonal, SO）、交正交類屬（bi-orthogonal, BO）、仔波包類屬（wavelet packet basis, WP）。就正交類屬而言，又區分了下述種類：Daubechies 最不對稱類型、Daubechies 最小非對稱類型、Coifflets、Meyer 仔波、及Battle-Lemarié 仔波。

離散仔波轉換，其母仔波與父仔波之公式表示，大底均無法以單一公式爲之，亦即無法以具體的封閉型態展示。它們的來龍去脈抽象複雜，且牽涉數個乘積合成序列，也因此我們無法從其數學式而連想到其具體波形與性狀，此外，各類屬所涉數學難以用簡短篇幅加以記述說明，此處我們首先介紹各類屬之主要數理特質或解析特性，再以所開發程式，行一些例示與說明，並章顯其表徵或具體行爲。

爲描述這些不同類屬仔波及其性狀，茲將所必需用到的公式與符號說明如下：設若一函數或一訊號爲 $f(t)$，而萊斯仔波函基之 2-比尺量度函數（2-scale scaling function）爲 $\phi(t)$ ，此函數亦或稱爲父仔波，相應之母仔波函數爲 $\psi(t)$，而衍生關聯仔波爲 $\psi_{j,k}(t) = \sqrt{2^j}\psi(2^j t - k)$，式中 $j, k \in \mathbb{Z}$，而 k 代表移位變數， j 代表縮放變數。圖 2.1 迄 2.6 示一些仔波的移位與縮放效應。

對某一 j 階位而言，一多階解析度階架（multiresolution ladder）之空間 V_j，

其系由 $\psi_{j,k}, k \in \mathbb{Z}$ 所形成，並以下述包含性關係存在$\cdots \subset V_{-1} \subset V_0 \subset V_1 \cdots$。設若一1024 點之訊號，則其最細與最粗之尺度空間則分別爲 V_{10} 與 V_0；另設若相關之仔波若爲有限支撐長度（finite support length），其波濾係數（filter coefficients）或旋移乘積權重（convolution weights）之數目爲 N，則其支撐分佈之長度（support length）是爲 $N-1$；若匹配（dual）仔波或匹配父仔波存在，則分別記爲 $\widetilde{\psi}(t)$ 與 $\widetilde{\phi}(t)$；而內積是爲 $\langle \cdot, \cdot \rangle$；另Kronecker delta 爲 $\delta_{j,k}, j, k \in \mathbb{Z}$，其中若 $j \neq k$ 則該式爲 0，若 $j = k$ 則該式爲 1。

迄今，所有具有實用效益的離散仔波轉換，都可謂與多階解析度分析法（multiresolution analysis, MRA）[5, 18] 有所關聯。對萊斯仔波而言，除了正交類屬之仔波其匹配仔波是自匹配（self dual）以外，各類離散仔波都存在另一不同之匹配仔波，而任何離散仔波轉換，必然都是包含兩個旋移乘積（convolution）運作過程，其一過程生成細部資料（detail information），另一過程則生成較平順之大體資料（smooth information）[23]。如果仔波函基其關聯之波濾係數是爲有限支撐長度分佈者，則旋移乘積之運作可以直接在時間領域進行，取得確切數值，亦或在頻率領域間接求算，取得近似數值。以下列出所探討之各仔波類屬，並說明前述諸變量或函數的屬性。

2.2 正交仔波

此處所含蓋之正交仔波類型計有：Daubechies 最精減支撐仔波，（即爲最爲非對稱者，記爲ONxxA）、Daubechies 最小非對稱仔波（ONxxS）、Coiflets（ONxxC）、Meyer 仔波（Meyer）、Battle 與Lemarié 仔波（B&L），文中之 x 符號代表一整數，其乃表示仔波支撐分佈之長度，或是代表母仔波形含蓋範圍，亦或是表示旋移乘積權重係數之數目。各正交仔波具有如下之通性：

$$\psi = \widetilde{\psi}, \tag{2.1}$$

$$\phi = \widetilde{\phi}, \tag{2.2}$$

$$\langle \psi_{j,k}, \widetilde{\psi}_{l,m} \rangle = \delta_{j,l}\delta_{k,m}, \tag{2.3}$$

$$f(t) = \sum_{j,k} \langle f, \psi_{j,k} \rangle \psi_{j,k}, \tag{2.4}$$

一個 MRA 階架，單一組架框極限值（One MRA ladder, single set of frame bounds），

一對波濾（One filter pair, i.e., one smooth and one detail）.

而各子類屬各有其另外特性如下。

2.2.1 Daubechies 最精減支撐仔波（ONxxA）

就一固定支撐分佈長度而言，此一類型之仔波具有最高數目之消失偶矩（即零偶矩，zero moment）；換個角度而言，就一定數目之消失偶矩來論，這一類型之仔波具有最短或最精減之支撐長度。最爲出名的一個最短支撐長度仔波，即爲僅需四個波濾係數的Daubechies 正交仔波。這類仔波之非對稱性非常顯著（因此ONxxA 之A 即代表asymmetric）。圖 2.7 與 2.8 示這一類型之母仔波與父仔波，其母仔波波形係取源出點爲第 12 點，相應源出層位或區分邊界點（區分smooth information 與detail information 之邊界點）爲第 2 階；其父仔波形係取源出點爲第 6 點，相應源出層位與區分邊界點相關層階爲第 3 階。此類屬之消失偶矩數目與波濾係數個數分別爲：

$$\int_{-\infty}^{\infty} t^l \psi(t) dt = 0, \quad l = 0, 1, \cdots, x, \tag{2.5}$$

$$N = 2x, x \geq 2. \tag{2.6}$$

式中之 x 爲出現於 ONxxA 之整數，而最小的 x 值是 2。

2.2.2 Daubechies 最小非對稱仔波（ONxxS）

就一固定支撐長度而言，相較於最不對稱的 ONxxA 來看，這類型之仔波是爲最接近對稱分佈者（因此 ONxxS 之 S 以代表之），不過它們仍是非對稱的。這類型

之仔波其消失偶矩數目與波濾係數個數相同於 ONxxA 者，然而其最小 x 是爲 4。

$$\int_{-\infty}^{\infty} t^l \psi(t) dt = 0, \quad l = 0, 1, \cdots, x, \tag{2.7}$$

$$N = 2x, x \geq 4. \tag{2.8}$$

圖 2.9 與 2.10 分別示這一類屬之母仔波與父仔波形，其各相關源始點同於圖 2.7 與 2.8。

2.2.3 Coiflets （ONxxC）

上述兩子類型之仔波其零偶矩只對應於母仔波，而 Coiflets 之特色則在於其母仔波與父仔波都存在有消失偶矩，也因爲這一特性，我們可以由泰勒級數展開的觀點來推論，這一函基之使用將可在細部小尺度訊息上產生高效率訊息壓縮作用，也就是說，一個訊號以這一類仔波之函基函數來分解時，將有一大部分之小尺度仔波轉換係數會是相對的小，而比較可以略去。也因此，其計算較小尺度大體滑順訊息（small scale smooth information）有簡易之配對規則（simple quadrature rule），亦即一個函數與小尺度父仔波之內積求算時會具有較高數值效率。而正如前述所言，任何離散仔波轉換必然都是包含兩個旋移乘積運作過程，其一過程生成細部資料，另一過程則生成大體而較平順之資料，如果能將兩種消失偶矩同時應用，則在某些應用上其效率可大爲提升，諸如那些不强調完美重建之數值處理、或可損壓縮系統。此類型之消失偶矩數目、父仔波積分值、與波濾係數個數分別爲：

$$\int_{-\infty}^{\infty} t^l \psi(t) dt = 0, \quad l = 0, 1, \cdots, x, \tag{2.9}$$

$$\int_{-\infty}^{\infty} \phi(t) dt = 1, \tag{2.10}$$

$$\int_{-\infty}^{\infty} t^l \phi(t) dt = 0, \quad l = 1, \cdots, x, \tag{2.11}$$

$$N = 6x.x \geq 1. \tag{2.12}$$

圖 2.11 與 2.12 分別示這一類型之母仔波與父仔波波形。圖中各參數亦取同於前些圖。

2.2.4 Meyer 仔波（ME）

前述之仔波我們所談論之支撐長度都是針對時間領域，而Meyer 則設計出一個Meyer 仔波（圖中記爲ME 或Meyer），它所强調的支撐長度則是針對頻率領域而論，也就是說這一仔波其頻率支撐分佈是現今所知之最簡短者，因而相應時支撐長度上則有相對明顯最長分佈（本文中，若無特別說明，則支撐長度即表針對時間領域）。而基於富立葉轉換相對應領域之對比特性，我們知道這一類型之仔波其波形是無限可微分的，再者，其 Lipschitz 規則度（regularity）是爲無窮大，另一方面，此亦表示其仔波函數分佈之衰減無法滿足指數減衰（exponential decay），而其支撐長度之N 值是爲無窮盡者。圖 2.13 示其母仔波與父仔波波形，各相關係數亦取同於前些圖。

2.2.5 Battle and Lemarié 仔波（B&L）

Battle 與 Lemarié 仔波（記爲 B&L 或 LE），是以樞點順適函數（cardinal B-spline）N_m [1, 2] 來架構其父仔波，其乃應用標準的正交化技巧於第 m 階樞點順適函數以形成正交之父仔波函數，再以這些父仔波函數構築形成母仔波。當 $m = 1$ 時，它的母仔波即爲 Haar 仔波（亦即Haar函數），而此一 Haar 仔波是這一類屬中唯一具有限支撐長度者，另外，其亦是非連續仔波中之最短支撐分佈仔波。再則，此一 Haar 仔波恰恰同於下述中之交正交仔波中之 BO11O=BO11D。這一類屬之其它仔波其支撐長度是無限分佈，不過它們具有指數衰減，且具有 C^{m-2} 規則度，圖 2.14 示其母仔波與父仔波形。與 Meyer 仔波比較起來，它們的諸多目視性狀都非常近似，然而我們從這兩種仔波之描述，可以體會到它們的函數構築、理倫設定、公式推演都是相當不一致的。精簡表示是：解析特性可以是南轅北轍，但目視性狀可以無甚差別。

2.3 半正交仔波（SOxO and SOxD）

半正交仔波（記爲 SOxO，其匹配仔波則記爲 SOxD）其仔波函基函數在不同尺度下是互爲正交，但其同尺度之不同移位函數則不正交。這一類屬之仔波其父仔波（或量度函數）是爲樞點順適函數 N_m，另其係由有限個數之 2-比尺關係式（2-scale relation）所形成。這一類屬之仔波具有兩組獨立之波濾係數群，一組相關於分解用途，一組則相關於訊號重建用途。雖然波濾係數群是有兩組，但其多階解析度分析架構（MRA V_j-ladder）則只有一組。這一類屬之仔波係爲 Chui [2, 3] 所提，並將之稱爲樞點順適仔波，另其研究亦指出，$m \geq 3$ 之樞點順適仔波都幾乎等同於調變高斯波形（不過，調變高斯函數並非是仔波），是故，此處我們只顯示第四階（$m = 4$ 或 $x = 4$）之三次方樞點順適（cubic spline）仔波所相關之母仔波與父仔波，如圖 2.15 所示，另圖中諸參數亦同前。這一類屬之仔波有如下解析特性：

$$\psi \neq \widetilde{\psi}, \tag{2.13}$$

$$\phi = \widetilde{\phi}, \tag{2.14}$$

$$\langle \psi_{j,k}, \psi_{l,m} \rangle = \langle \widetilde{\psi}_{j,k}, \widetilde{\psi}_{l,m} \rangle = \delta_{j,l}, \tag{2.15}$$

$$f(t) = \sum_{j,k} \langle f, \psi_{j,k} \rangle \widetilde{\psi}_{j,k} = \sum_{j,k} \langle f, \widetilde{\psi}_{j,k} \rangle \psi_{j,k}, \tag{2.16}$$

$$N = 3x - 1 \quad \text{for SO}x\text{D}, \tag{2.17}$$

$$N \to \infty \quad \text{for SO}x\text{O}, \tag{2.18}$$

一個 MRA 階架（One MRA ladder），

兩對波濾（Two filter pairs ）.

2.4 交正交仔波（BOxyO and BOxyD）

此類屬之仔波亦係由 Dauchbies 所建構，實質上它們是屬於非正交之類型。對所有的實數類並且是有限支撐長度之正交仔波而論，沒有一個是具對稱性的（ Haar 仔波僅可視爲部分符合對稱性）。然而從訊號重建的觀點而言，若吾人希望僅用部分之轉換係數爲之，那轉換之波濾係數之分佈性狀，在實証上，是一個重要的因子，因爲經驗告訴我們，對稱性的波濾係數分佈，對轉換結果可以在視覺上帶來一種柔順、漸進、不突兀的變化。亦即使用非對稱性的函基函數，則一個微小的波形改變或局部更動，那前後兩個轉換結果比較起來，其廣大範圍之尺度訊息就會有差異極大的變異，這往往讓人失去對趨勢的掌握與尋跡性。換句話說，數據分析之結果若欲對其物理解說不致造成重大衝擊，容易理出來龍去脈，那訊號稍微改變時，轉換係數也最好是稍微變化就好。若非如此，則考慮到資料量測難免有各式各樣的誤差、糙音、污染、等未知因子影響，如果這些非可控因子就已經給我們的轉換結果帶來莫大的衝擊，那就遑論我們能對所研究因子之變易能有任何追蹤能力了。綜此言之，函基函數之對稱性分佈，在物理研究上是一個非常重要的因子。而如前所述，有限支撐正交函基函數沒有是具對稱性的。那如果犧牲了正交性而可取得一些對稱性，應是值得的。也如是乎，交正交仔波或許可在物理探討發揮一些作用。交正交仔波函基存在有兩對母仔波與父仔波，亦即存在一組匹配仔波。綜合比較起來，我們可以體會到，半正交仔波其存在條件較正交仔波者來的普通；而交正交仔波之存在條件則又比半正交仔波者來的鬆散。這些可以由交正交仔波記號中所出現的兩個參數 x、y 看出。雖然這一類屬之仔波是有兩組母仔波與匹配仔波，而其所涉之多階解析度分析（MRA）亦有兩組，但它們所涉之波濾係數卻只有唯一組，這一點與半正交仔波函基者恰相反。半正交仔波下其多梯階解析分析（MRA）只有一組，但有兩組波濾係數群。圖 2.16 迄 2.19 示此類屬之母仔波與父仔波，暨相應之匹配母仔波與父仔波。其相應解析特性爲：

$$\psi \neq \widetilde{\psi}, \tag{2.19}$$

$$\phi \neq \widetilde{\phi}, \tag{2.20}$$

$$\langle \psi_{j,k}, \widetilde{\psi}_{l,m} \rangle = \langle \phi_{j,k}, \widetilde{\phi}_{l,m} \rangle = \delta_{j,l}\delta_{k,m}, \tag{2.21}$$

$$f(t) = \sum_{j,k} \langle f, \psi_{j,k} \rangle \widetilde{\psi}_{j,k} = \sum_{j,k} \langle f, \widetilde{\psi}_{j,k} \rangle \psi_{j,k}, \tag{2.22}$$

$$N = 2y + x - 1 \quad \text{for BO}x\text{O}y\text{O and } x \text{ odd}, \tag{2.23}$$

$$N = 2y + x - 2 \quad \text{for BO}x\text{O}y\text{O and } x \text{ even}, \tag{2.24}$$

$$N = 2y + x - 1 \quad \text{for BO}x\text{O}y\text{D and } y \text{ odd}, \tag{2.25}$$

$$N = 2y + x - 2 \quad \text{for BO}x\text{O}y\text{D and } y \text{ even}, \tag{2.26}$$

兩個 MRA 階架（Two MRA ladders），

一對波濾（One filter pair）.

此處仔波的移位與縮放效應相關程式爲

- `R_TnD.shl`

母仔波與父仔波相關程式爲

- `R_DnR.shl`
- `LLet-DnR.asy`

另整體上的核心程式有

- `LLet-000.asy`
- `LLet-Mai.asy`
- `LLet-Coe.asy`
- `LLet-Act.asy`

2.5 仔波包（WP）

以正交仔波函基轉換所得之係數，是可以再次被轉換分解的，甚至是多層次、多局部的再次分解。這類的分解與轉換即稱之爲仔波包轉換。而所涉再次分解之函基可以是原始的正交函基亦或是任何其它正交函基。也因此仔波包轉換其分解結果可說變化無窮。此類轉換之接續分解難以用簡易公式表示出，但它的流程可以用一淺顯，逐層逐步增加之分割，示意如圖 2.20。其乃類如樹狀分支之延伸作業。仔波包轉換係數與原初始轉換係數比較起來，就是它的轉換係數所代表的頻帶解析，或尺度帶解析，更爲細密，而相對地其所代表的時支撐長度也就增長了。這一比較細密頻帶的物理表徵是有些類似群波合成效應，也就是說，它們在波形顯現上有一種成包、亦或成群的性狀，此亦是仔波包命名的源出。

一組仔波包轉換係數之擇取雖然有很大的彈性，但也必需遵守一些規則。就以樹狀圖解說爲例，每一垂直行上必須僅有一次、或一個格子出現機會，而每一水平列其格子，不論寬或窄，雖可有多格出現，但必需符合垂直行上不重覆之條件。也由於這種樹狀分支的彈性流程，相關的數值計算工作量就增加不少。而如何擇取一組所要的係數也就有不同的考量。一般較常見的有兩種選擇規範，一者稱之爲最適函基仔波包（best basis wavelet packet），一者稱之爲最適階仔波包（best level wavelet packet）。現在就以一個以 1024 點的訊號來說明：此時轉換係數有 1024 個，其最細尺度階位是發生於 $j = \log_2 1024 = 10$，最大尺度階位發生於 $j = 1$，經過樹狀分解後所形成的係數群組選擇彈性有 2^{10} 種，而在這 2^{10} 選擇中，其所造成之熵值是爲最小的即稱之爲對應於最適仔波包函基之係數：而如果所有的係數只從同一階位、或同一水平列來擇取，此時我們有 0 到 9 階位，共 10 種取法，其中熵值來的最小的，即稱之爲最適階位仔波包轉換係數。仔波包轉換係數其排序指標，即圖中 U 之上下標，是代表了該係數之時間發生位置，同時亦代表該係數所對應之尺度或頻率，另一方面亦及於波形分佈支撐與性狀，或亦可說是二維時頻窗分佈圖中，不同係數所出現的性狀及位置。不過，實際上，這樣的二維圖示僅是代表性落點位置，與眞實分佈與性狀是不同的。有關仔波包轉換之時頻窗分佈概念可見圖 2.21。圖中亦示仔波包轉換是相應於非對稱性波濾，

此外亦示仔波包轉換係數其所代表的時頻窗之面積大小都是相等的。圖 2.22 與圖 2.23 示相關於 Daubechies ON22A 之兩個仔波包波形。與時頻窗之分佈圖比較起來，我們可以瞭解時頻窗所代表的是僅僅爲一種不完美的表意方式。

此處仔波包相關 Asyst 程式爲

- `R_Lev.shl`
- `LLet-Lev.asy`
- `S_WPM.shl`
- `LLet-WPM.asy`

相關二維圖示 Mathematica 程式爲

- `TFR-WP_Shell`
- `TFR-WP_Stand-alone`

2.6 仔波爆展與碎裂自似性

仔波實質上是具有碎裂自似性的（fractal nature），也就是說，無論我們任何地放大它的局部，較細尺度之波形與較粗尺度之波形是一樣的。另一方面則可說爲，不同爆展比（blowup）例下的曲線其性狀是一樣的，諸如曲線的可微分性、規則度、衰減特性等，是不變的。

此處所開發的程式可以針對任何仔波之各式建構加以爆展顯示，諸如，母仔波、父仔波、仔波函基、仔波包函基、各個階位、任意點位等。圖 2.24 迄 2.31 示一些仔波類屬之曲線爆展性狀。由這些圖可見，那些具有比較特殊，亦或是具有相對引人入勝之數學特性的仔波，其波形一般皆較突兀，而性狀怪異。事實上我們可以很直覺地說，對我們研究水波現象者而言，重要的是在求得物理解說，而這些怪異的形狀，其與弦性波的莫大差別，在在暗示著，求取物理解析無異是緣木求魚。也如是，這些特殊性狀的仔波根本不可能是我們所該選擇的對象。另外

還有一點可以加强這種論調，那就是從這些爆展曲線的收斂穩定性來看（此外，亦可從後頭章節中對熵值之探討結論中証得）。由圖可見，那些具有突出數學解析特性的仔波，其數值穩定性往往很差，甚至是發散的。再者，由這些爆展圖我們可以看到一些數值行爲或與理論特性，如終端兩側效應、有限解析之影響、誤差傳遞擴散現象、變化性或規則度等。

圖 2.30 及 2.31 分別示交正交仔波 BO31O 與 BO35O 之爆展。就 BO31O 而言，相關參數爲：仔波曲線對應源頭點是爲階位 2、點位 12 （亦即圖 2.20 中之單元 U_2^{12} ），爆展中心位置點位 150，據數或爆展長度 512 點，相鄰圖之爆展尺度比爲 2^6。就這一仔波而言，其爆展結果迅速發散，因而仔波在更細尺度下失去了其應有之碎裂自似性。就 BO35O 而言，相關參數爲：仔波曲線對應源頭點是爲階位 2、點位 12 （亦即圖 2.20 中之單元 U_2^{12} ），爆展中心位置點位 225，據數或爆展長度 512 點，相鄰爆展尺度比爲 2^6。就這一仔波而言，其爆展結果雖不發散，但仔波在更細尺度下失去了其曲線形狀傾斜之固定性。圖亦可見，與原仔波比較起來，何以仔波包之所以稱之爲包，因爲一個仔波包波形與它的源起仔波的波形比較起來，是有更多的波動起伏，並有類似一種聚群而成包的特性，但這種聚群成包現象不似富立葉弦性群波所具有的重現性，那樣的重現性乃因爲富立葉函基之週期行爲而生。

此處爆展相關 Asyst 程式爲

- `R_Blo.shl` ➲
- `LLet-Blo.asy` ➲ ❖

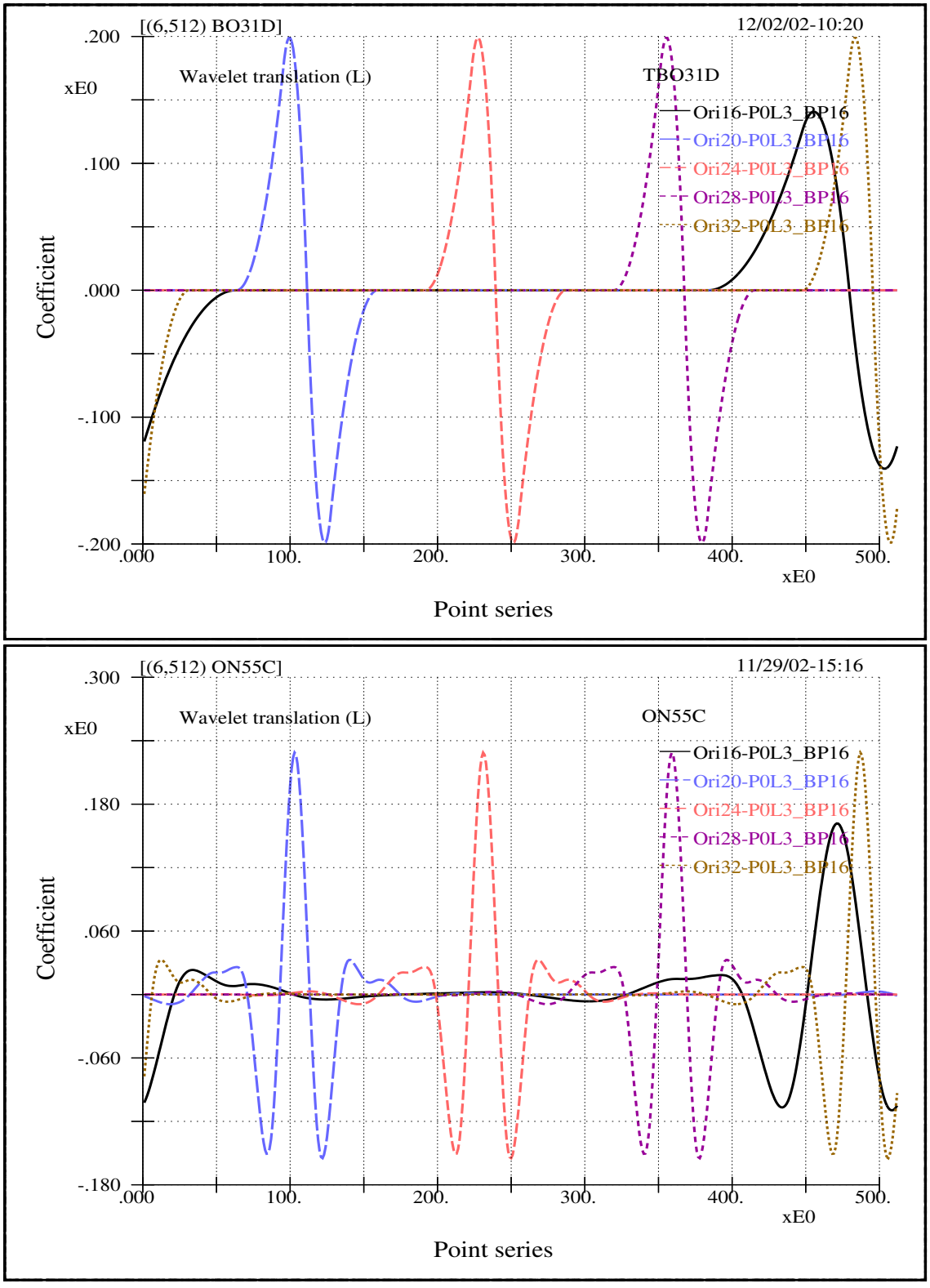


圖 2.1　仔波移位變數之效應。圖中仔波尺度係屬階位 3。

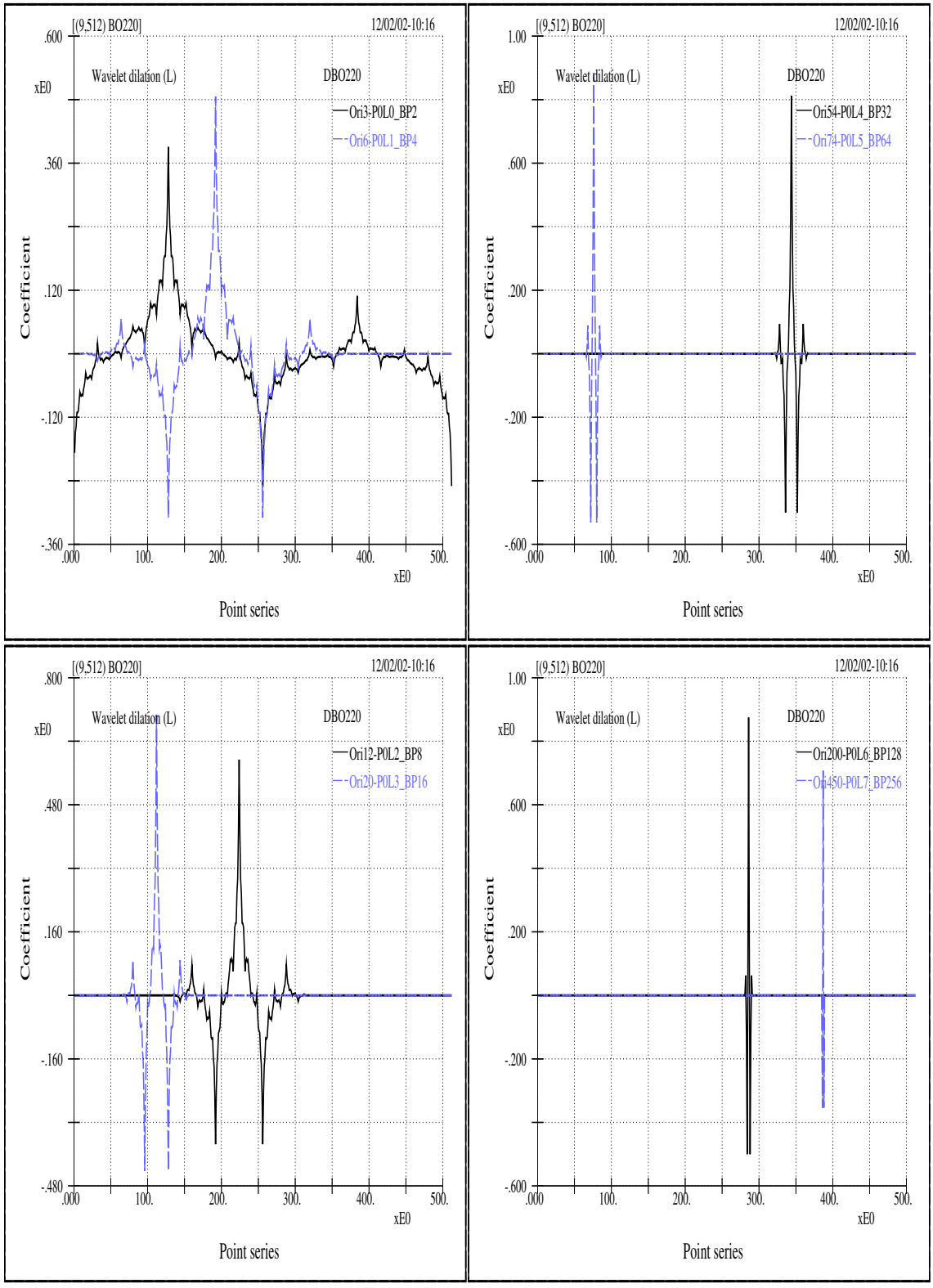


圖 2.2　仔波比尺縮放變數效應。圖示比尺階位由 0 到 7，所用仔波爲 BO22O ，而各波形所對應之移位點則標於圖中。

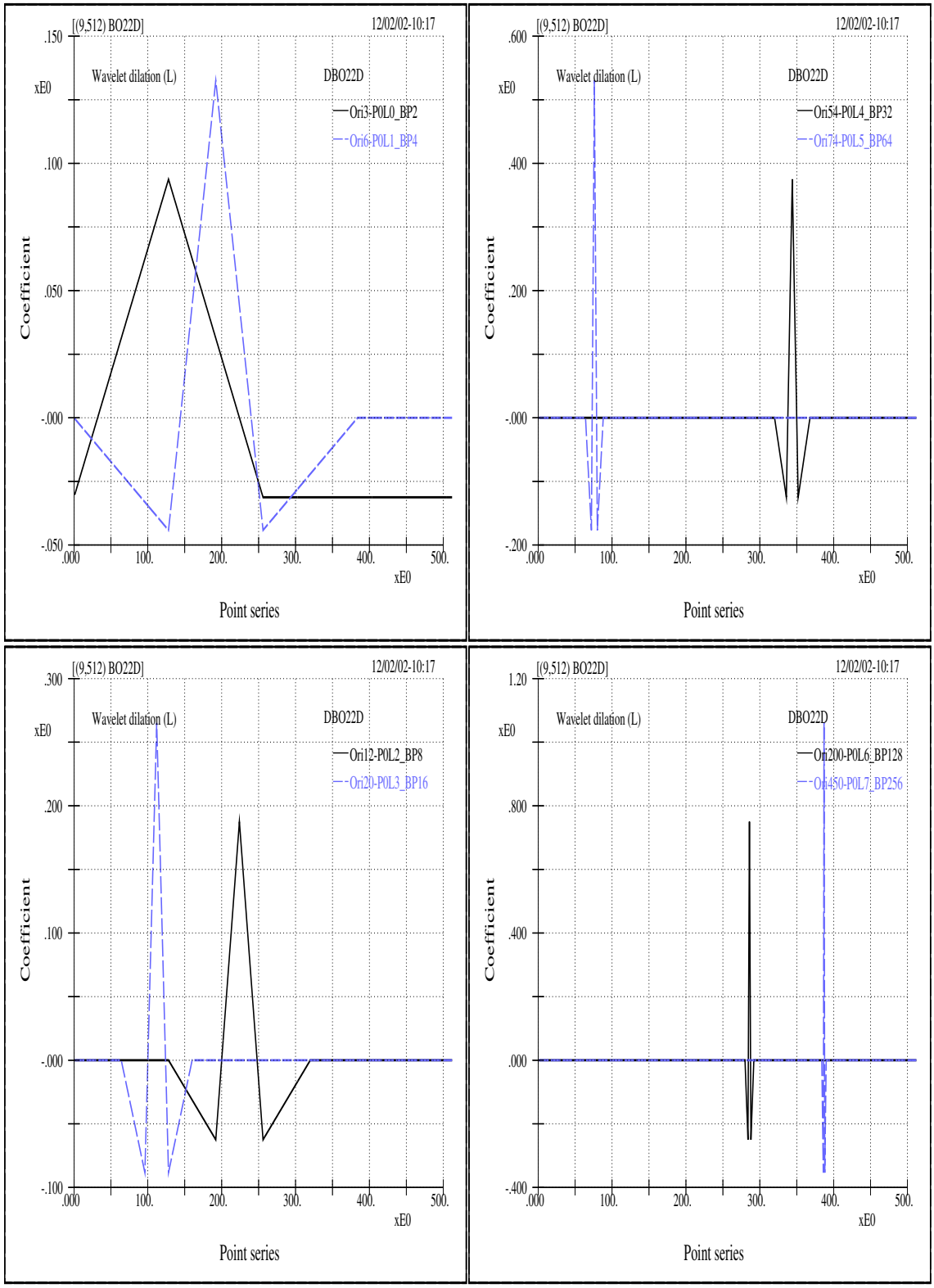


圖 2.3　仔波比尺縮放變數效應。圖示比尺階位由 0 到 7，所用仔波爲上圖之匹配仔波 BO22D ，而各波形所對應之移位點則標於圖中。

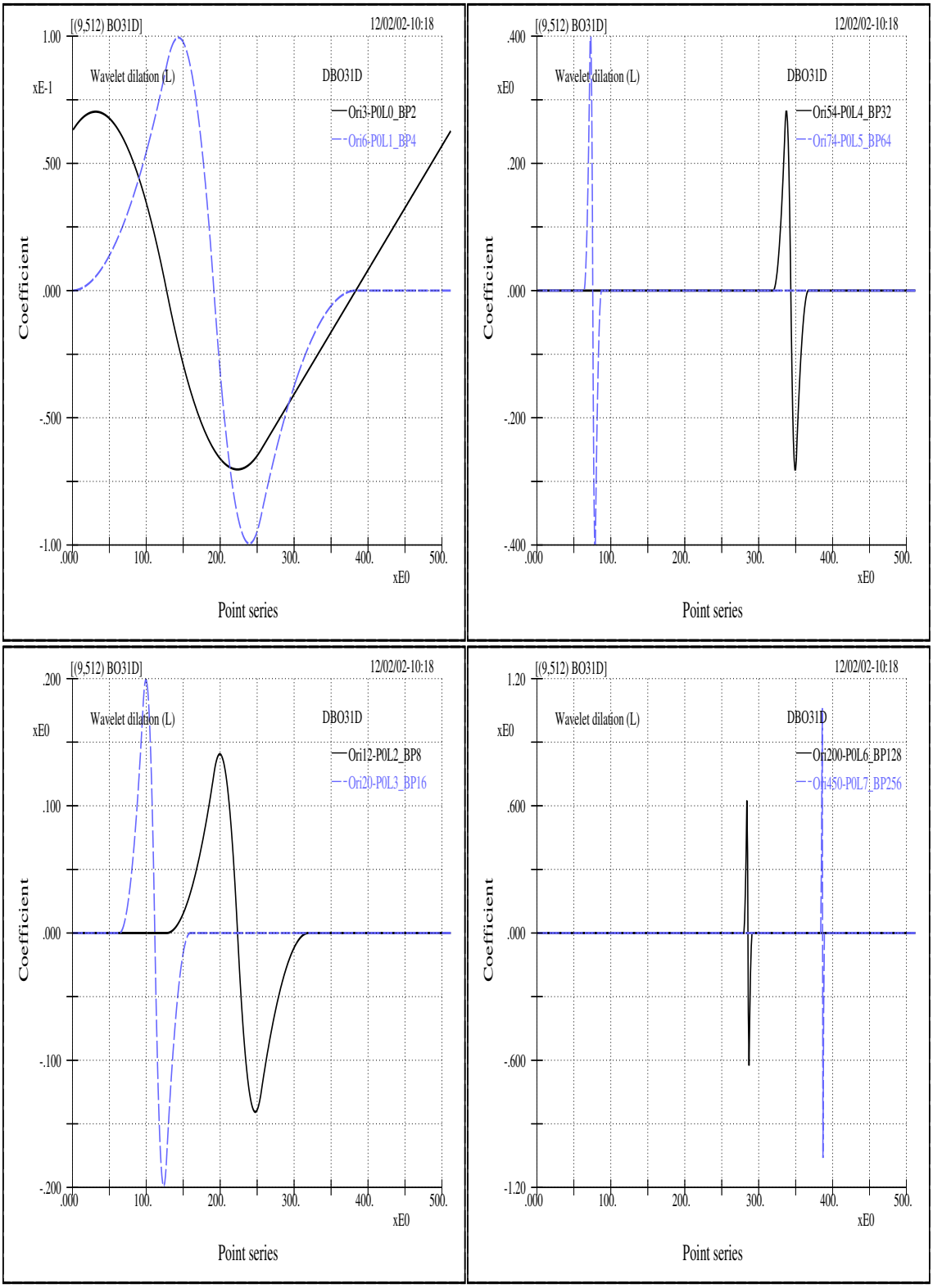


圖 2.4　仔波比尺縮放變數效應。圖示比尺階位由 0 到 7，所用仔波爲 BO31D ，而各波形所對應之移位點則標於圖中。

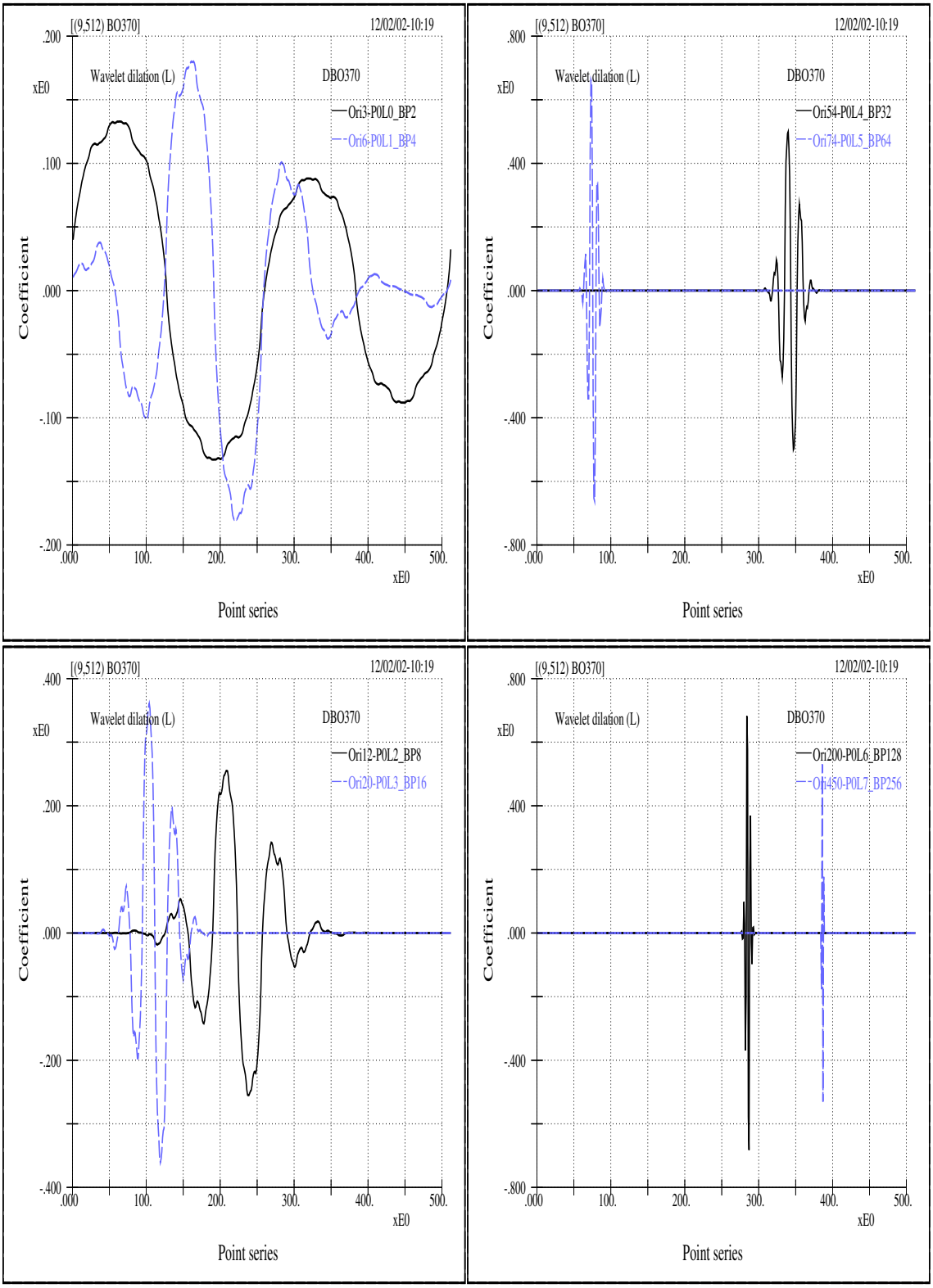


圖 2.5　仔波比尺縮放變數效應。圖示比尺階位由 0 到 7，所用仔波爲 BO370 ，而各波形所對應之移位點則標於圖中。

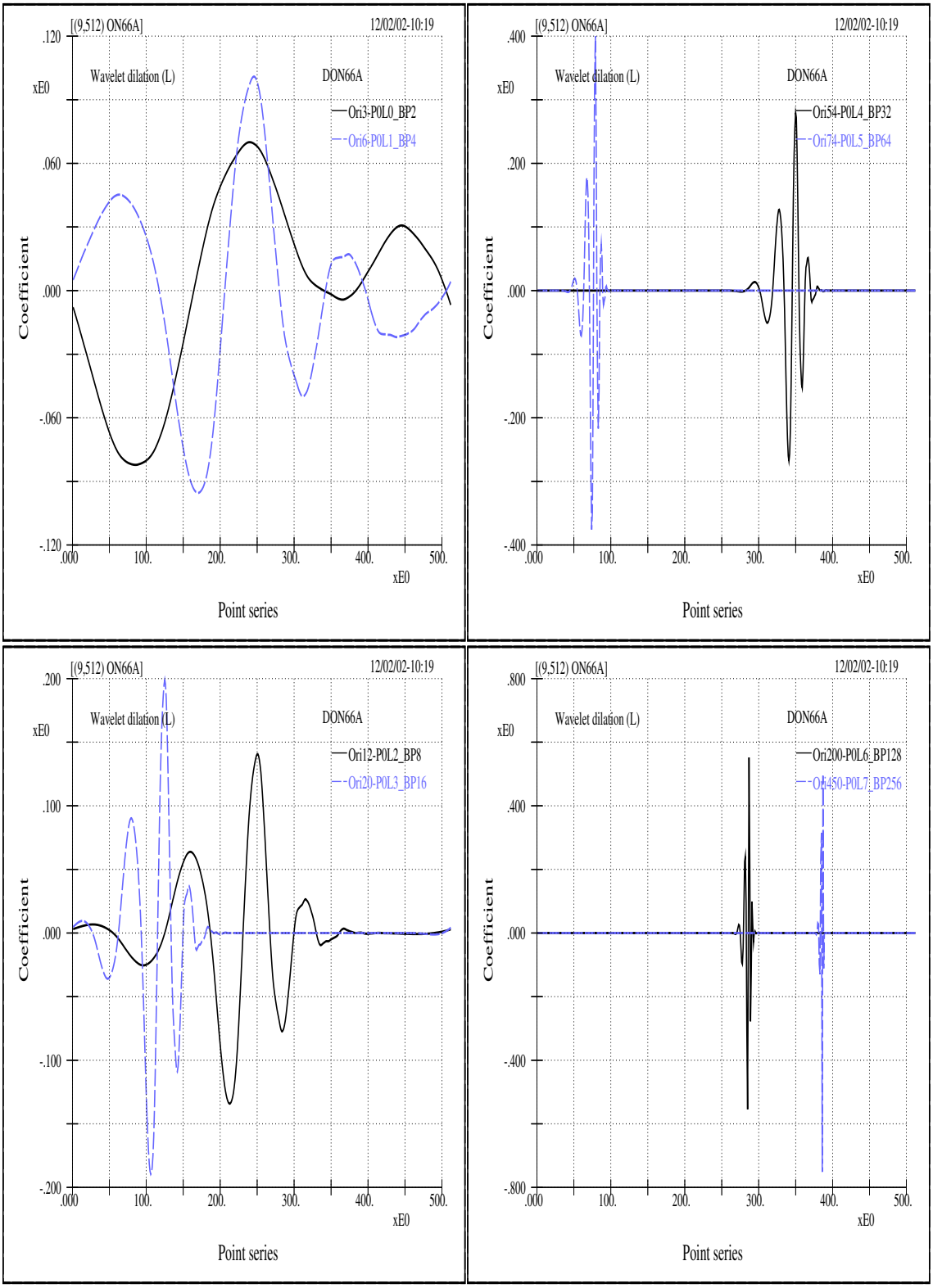


圖 2.6　仔波比尺縮放變數效應。圖示比尺階位由 0 到 7，所用仔波爲 ON66A ，而各波形所對應之移位點則標於圖中。

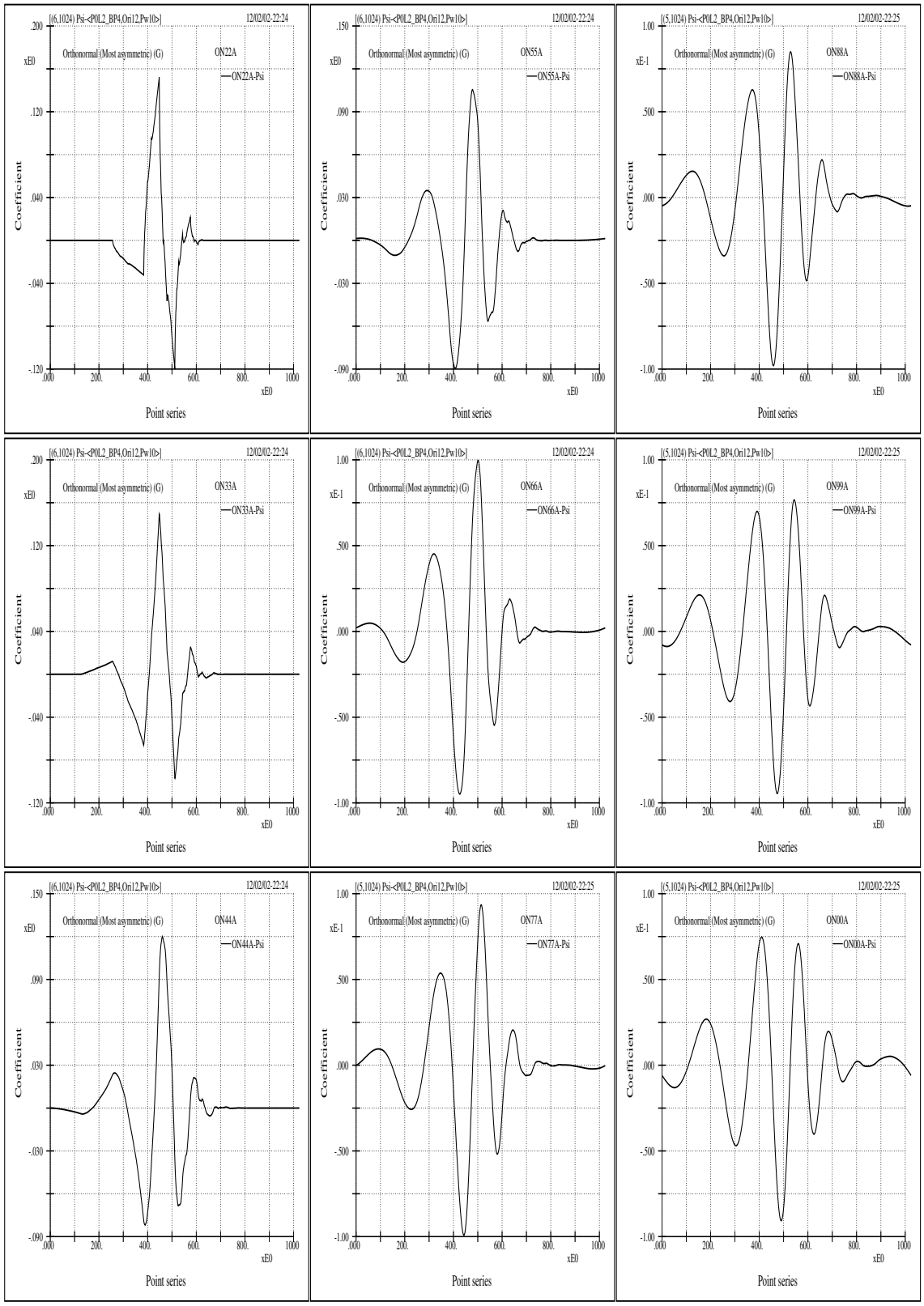


圖 2.7　ON*xx*A 類屬之母仔波波形。源起點爲 12，階位（即區隔 smooth information 與 detail information 之邊界點階位）小於或等於3。

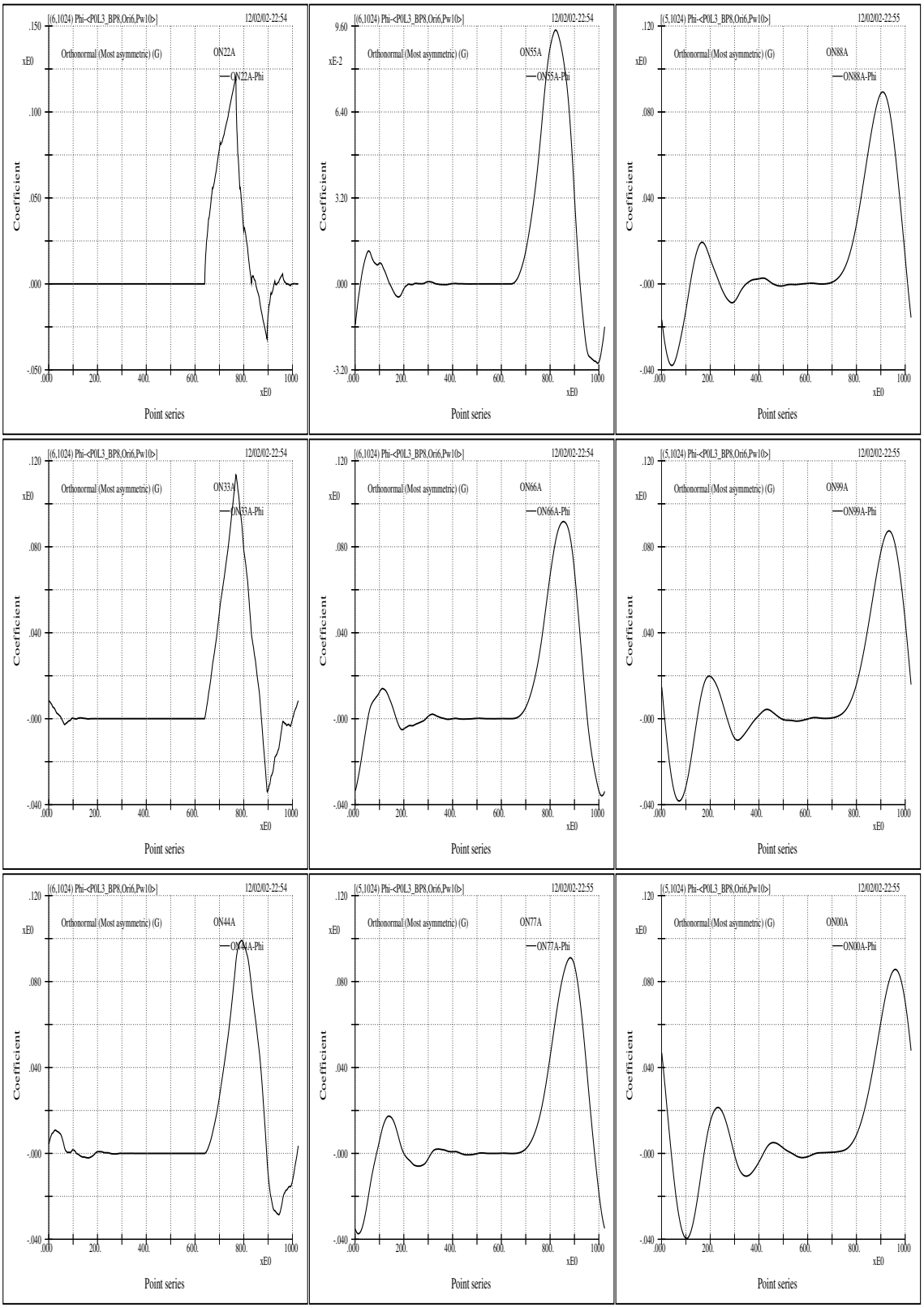


圖 2.8　ON*xx*A 類屬之父仔波波形。源起點爲 6，階位（即區隔 smooth information 與 detail information 之邊界點階位）大於 3。

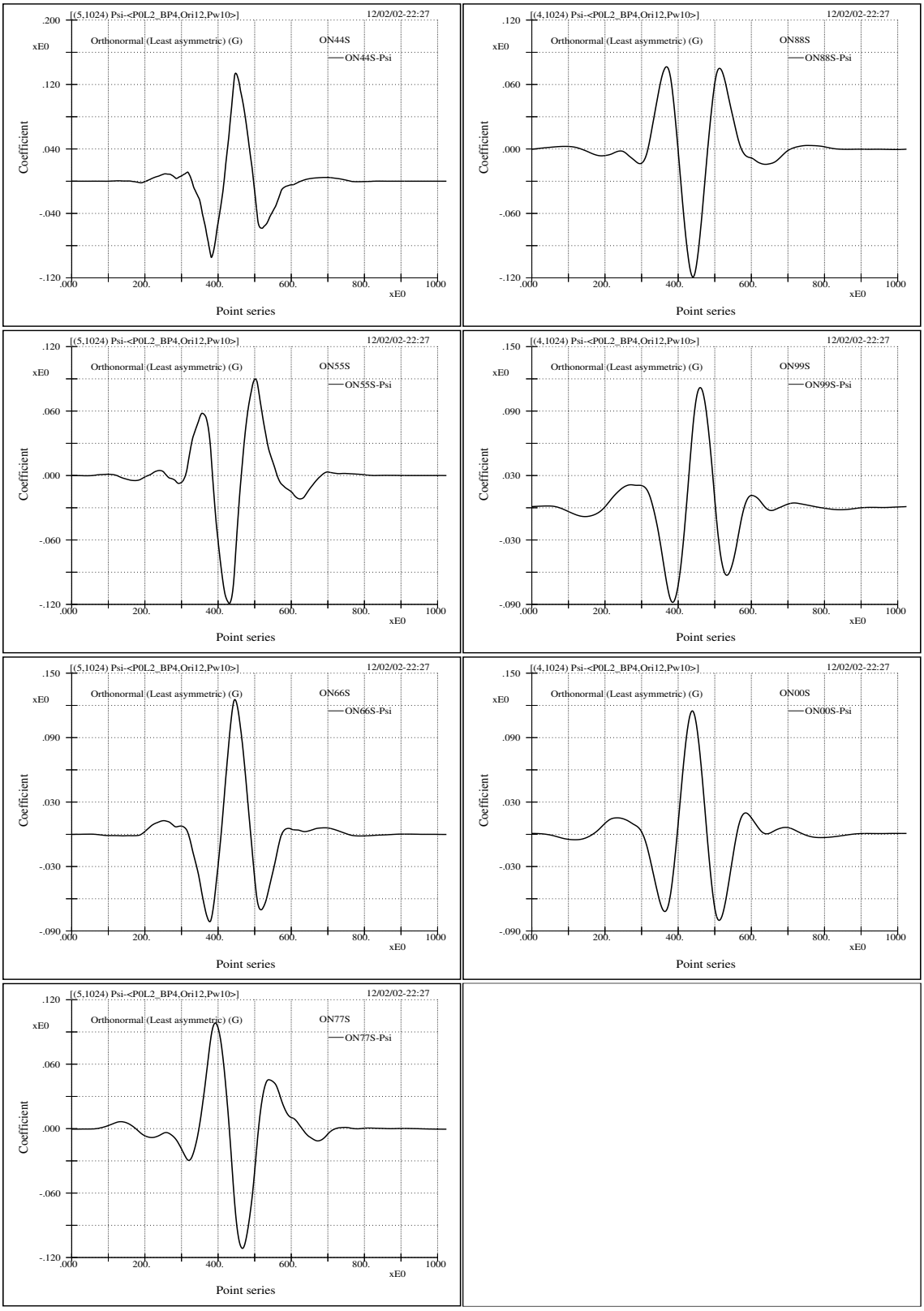


圖 2.9　ON*xx*S 類屬之母仔波波形。源起點爲 12，階位（即區隔 smooth information 與 detail information 之邊界點階位）小於或等於 3。

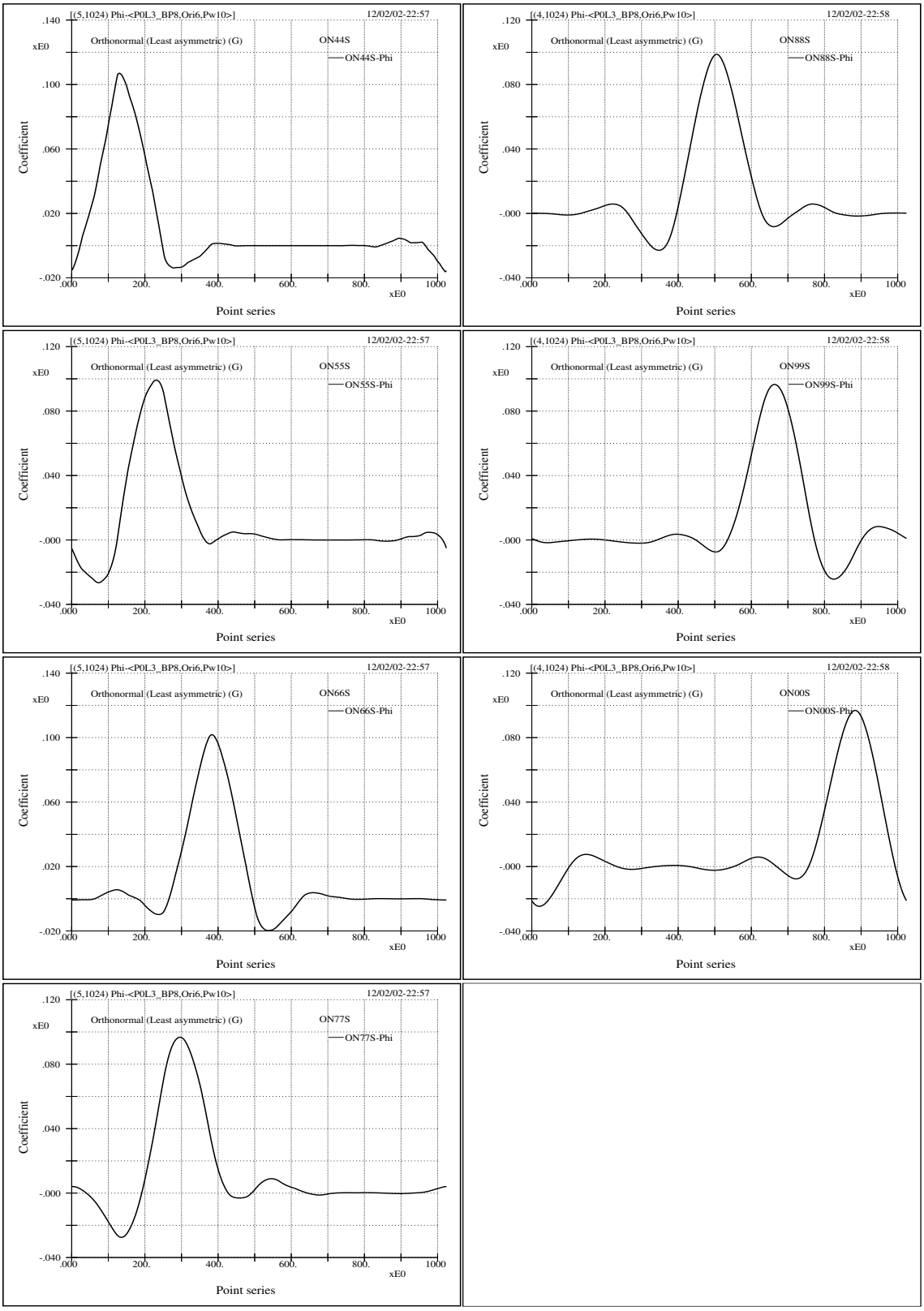


圖 2.10　ON*xx*S 類屬之父仔波波形。源起點爲 6，階位（即區隔 smooth information 與 detail information 之邊界點階位）大於 3。

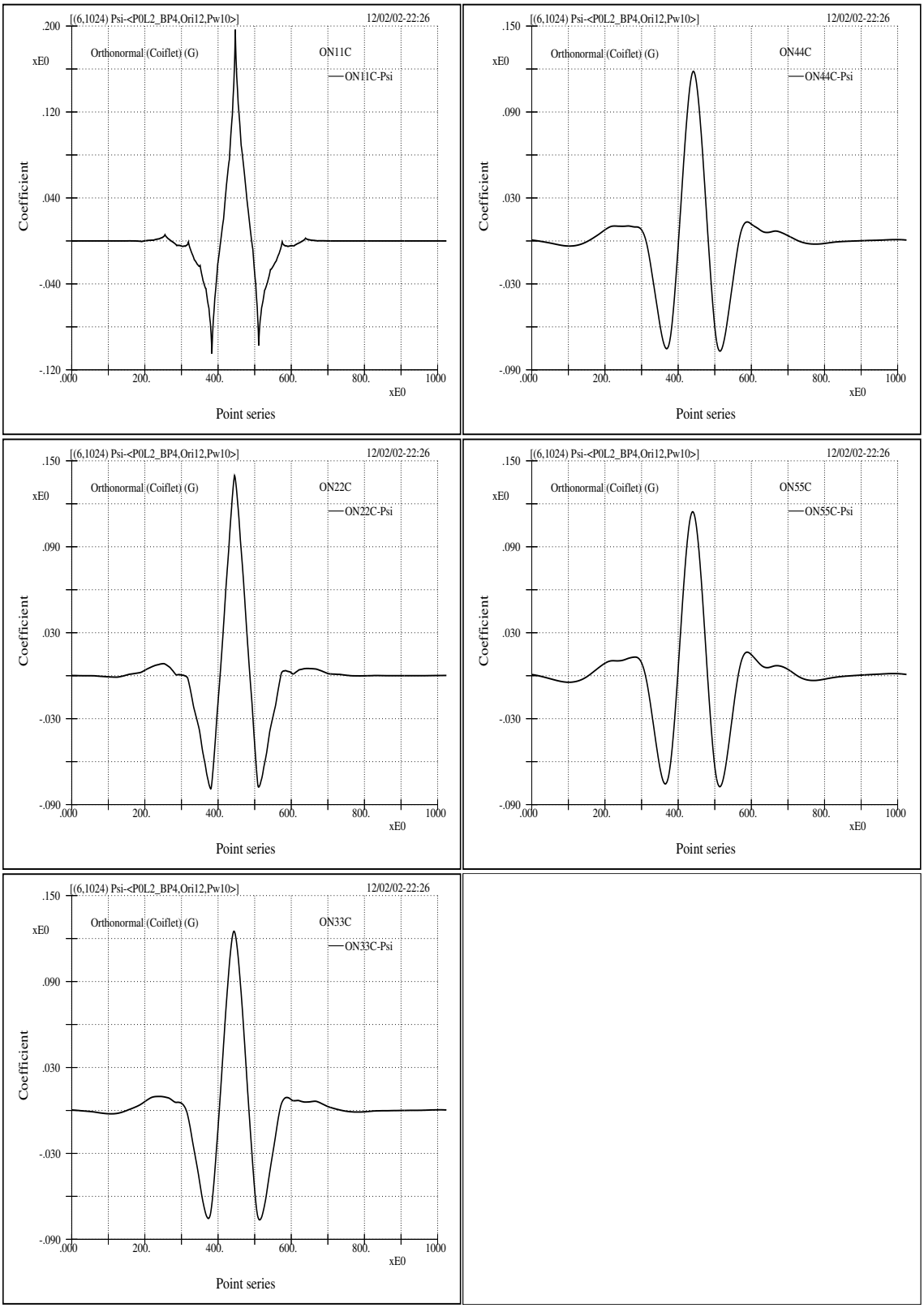


圖 2.11　ON*xx*C 類屬之母仔波波形。源起點爲 12，階位（即區隔 smooth information 與 detail information 之邊界點階位）小於或等於 3。

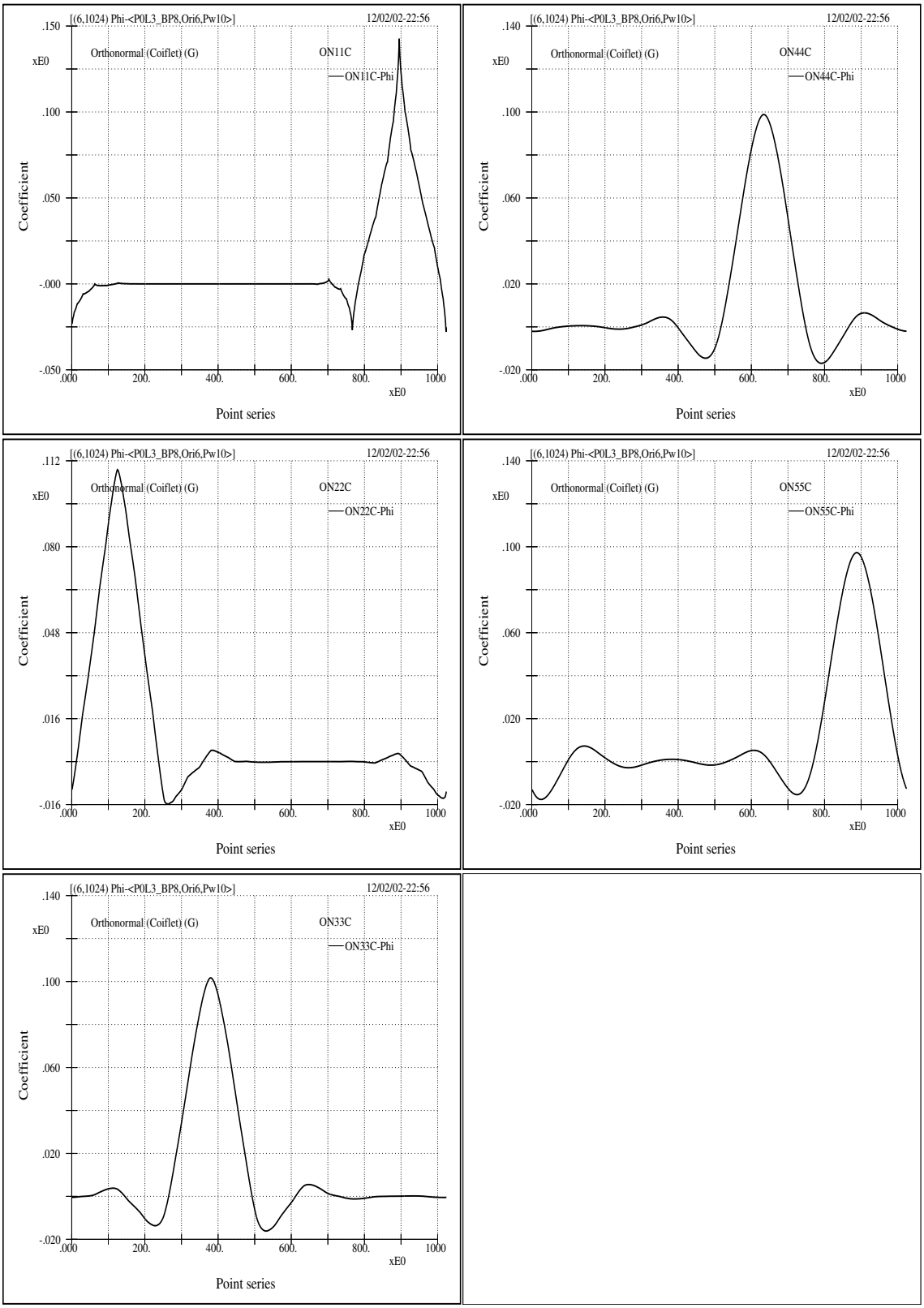


圖 2.12　ON*xx*C 類屬之父仔波波形。源起點爲 6，階位（即區隔 smooth information 與 detail information 之邊界點階位）大於 3。

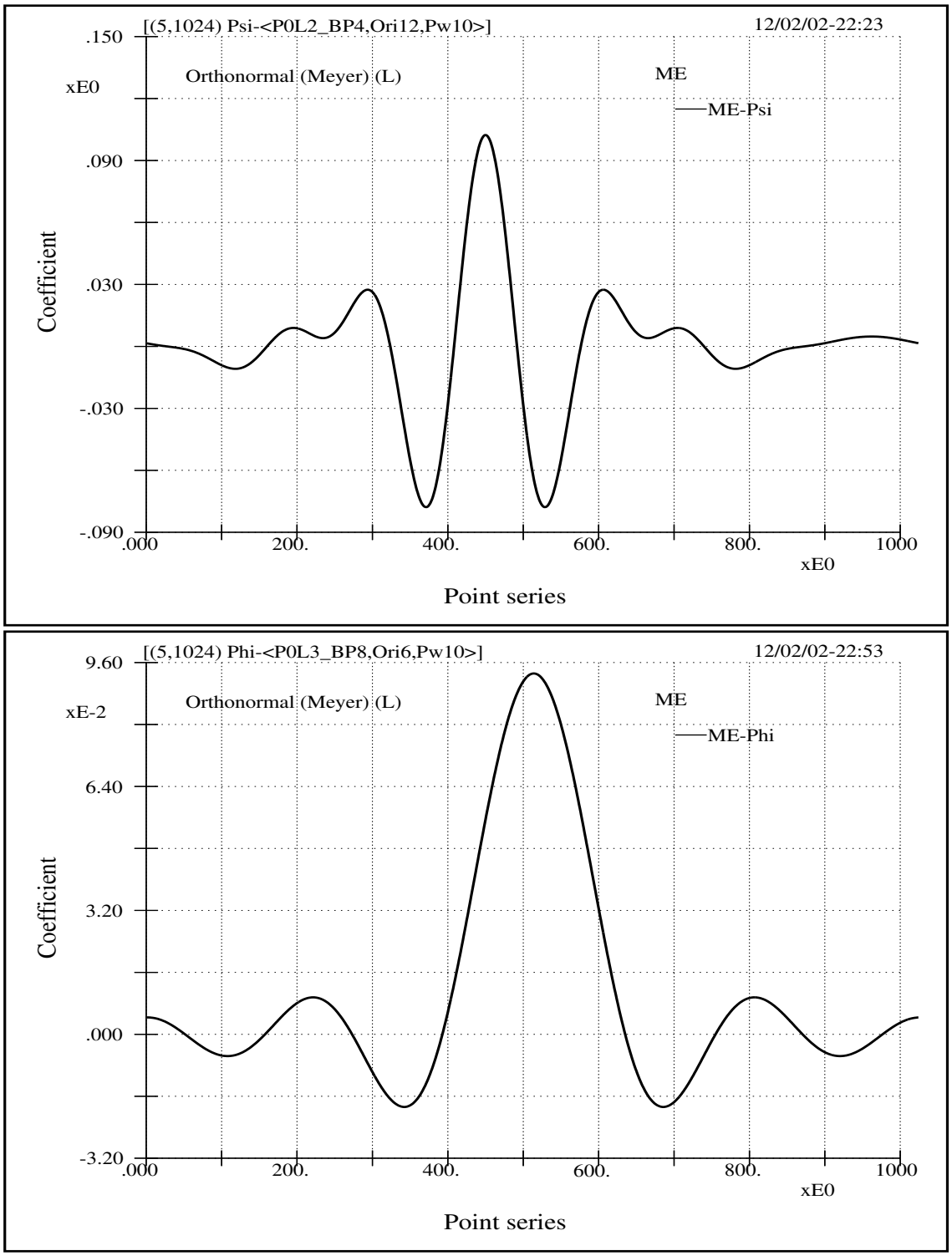


圖 2.13　Meyer 母仔波（上子圖）與父仔波（下子圖）波形。源起點分別爲 12 與 6 ，區隔階位（即區隔 smooth information 與 detail information 之邊界點階位）等於 3。此圖與下一圖比較，具有重要義涵。

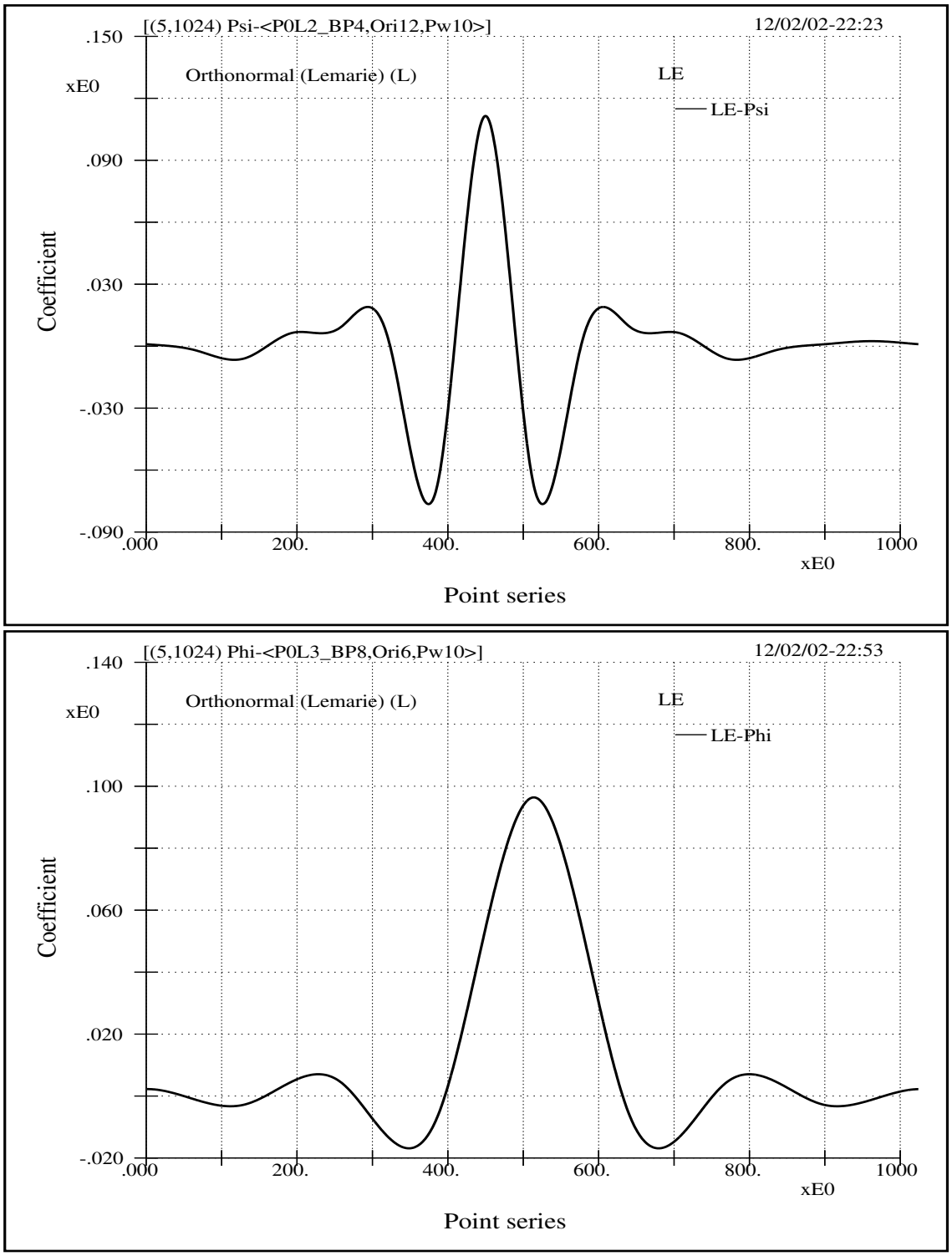


圖 2.14　Battle and Lemarié 母仔波（上子圖）與父仔波（下子圖）波形。源起點分別爲 12 與 6，區隔階位（即區隔 smooth information 與 detail information 之邊界點階位）等於 3。比較此圖與上一圖，其目視性狀可說非常近似，然而這兩種仔波之函基構築、理倫設定、公式推演都是相當不一致的，另其諸解析特性（如規則度、可微性、衰減率、支撐長度等）亦甚不同。如是，解析特性可以是南轅北轍，但目視性狀可以無甚差別。

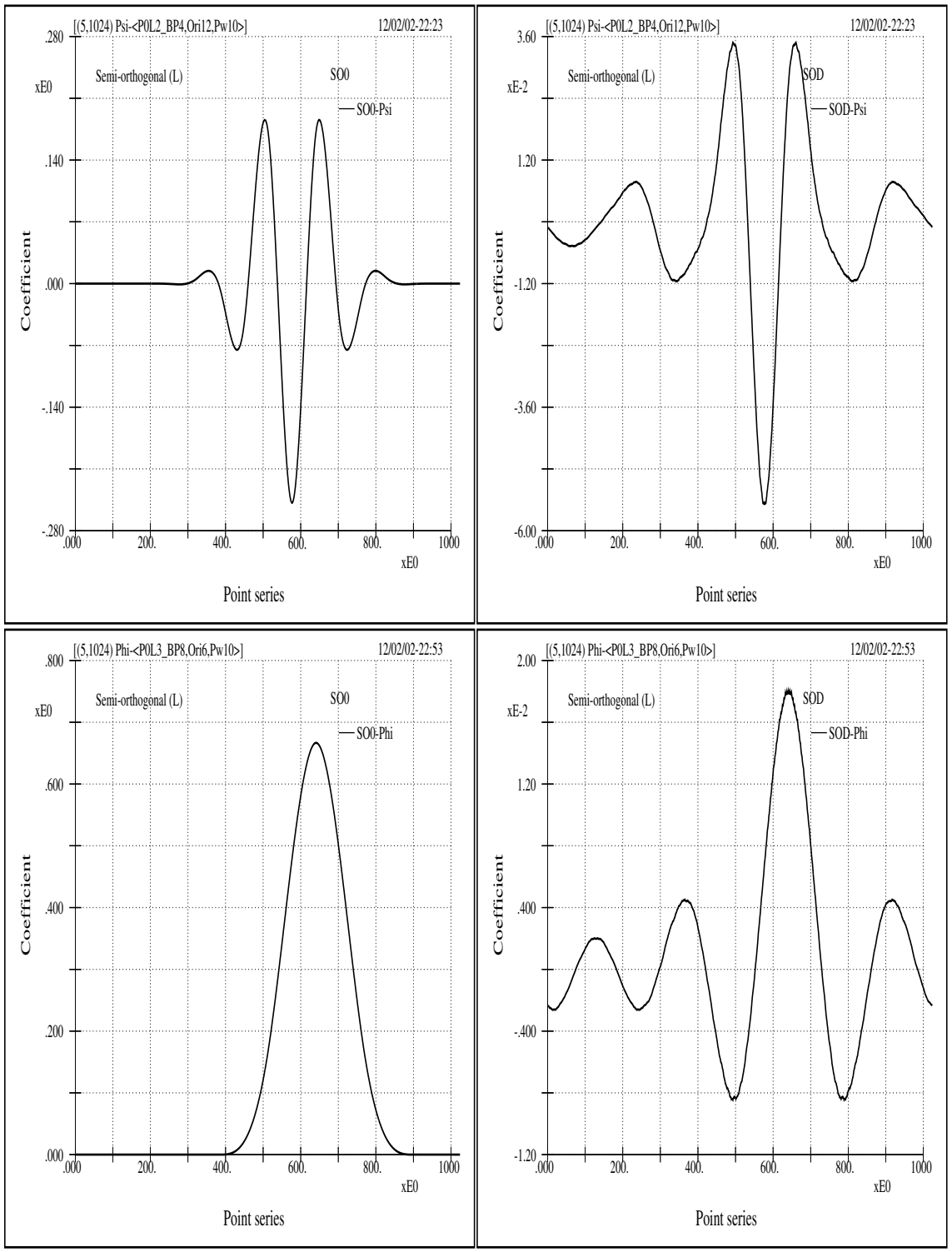


圖 2.15　半正交仔波其母仔波（上左子圖）、父仔波（下左子圖）、各匹配仔波（右兩子圖）之波形。源起點分別爲 12 與 6 ，區隔階位（即區隔 smooth information 與 detail information 之邊界點階位）等於 3。

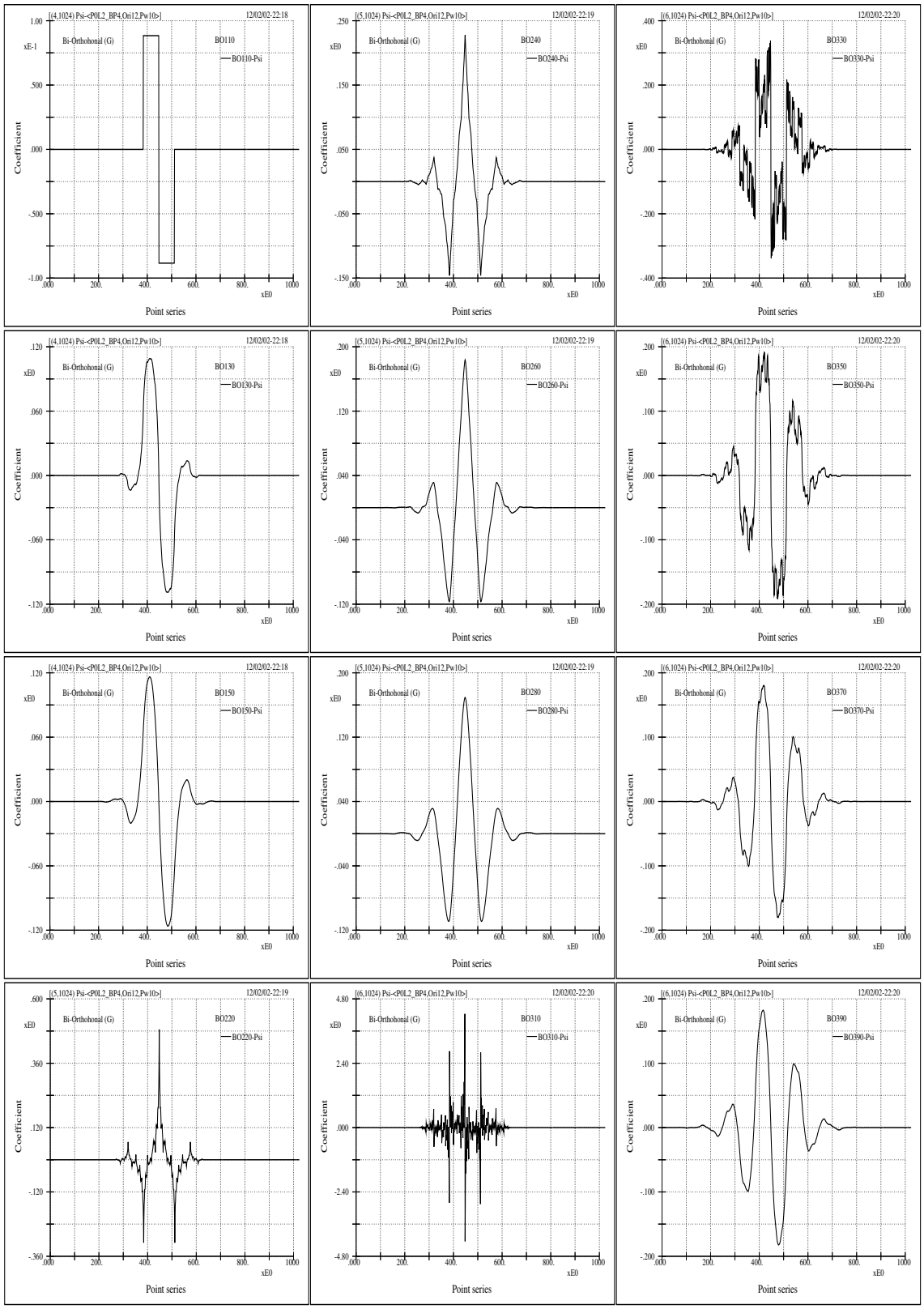


圖 2.16　交正交仔波類屬 BO*xx*O 其母仔波之波形。源起點爲 12，階位（即區隔 smooth information 與 detail information 之邊界點階位）小於或等於 3。

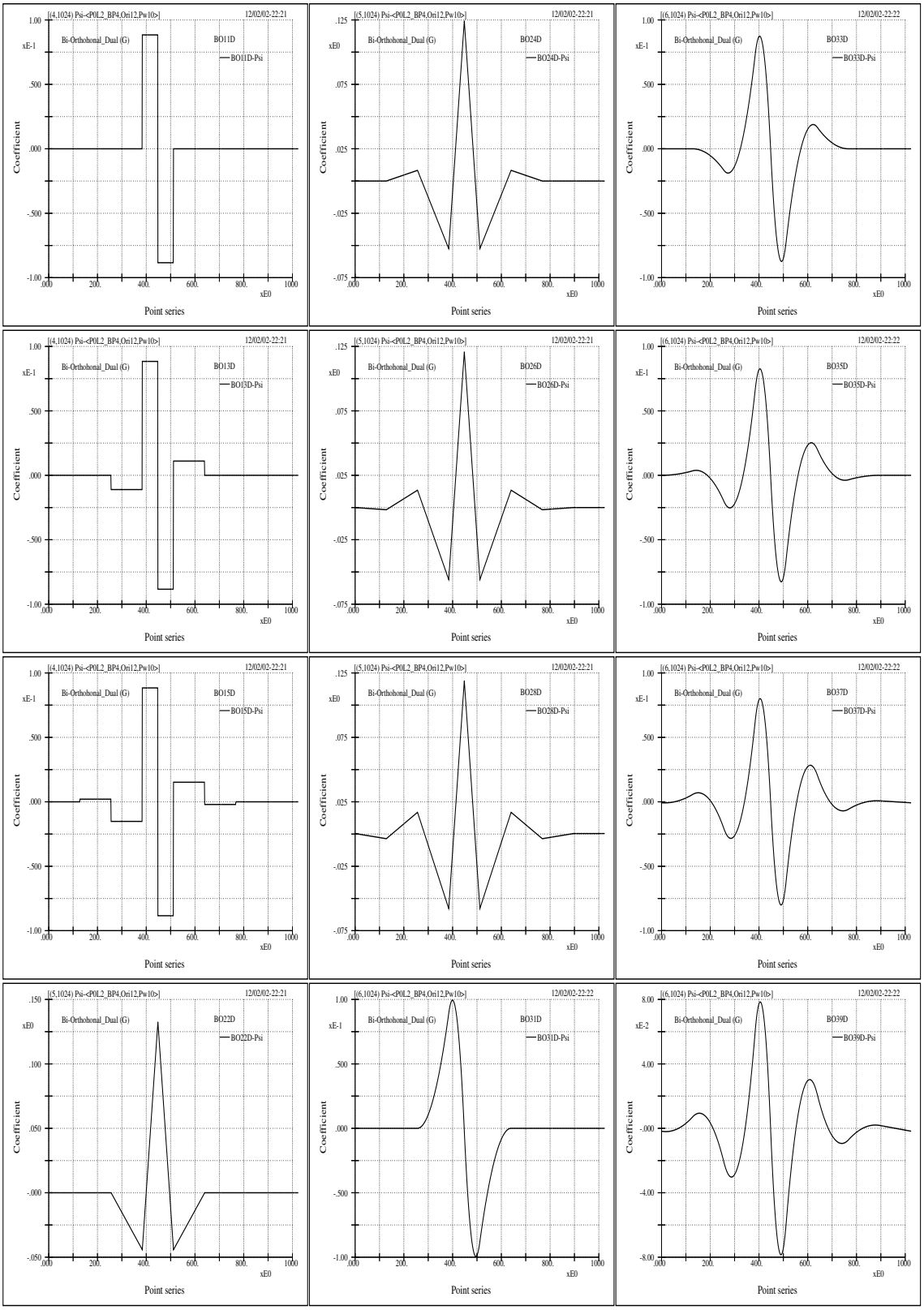


圖 2.17　交正交仔波類屬 BO*xx*D 其母仔波之波形。源起點爲 12，階位（即區隔 smooth information 與 detail information 之邊界點階位）小於或等於 3。

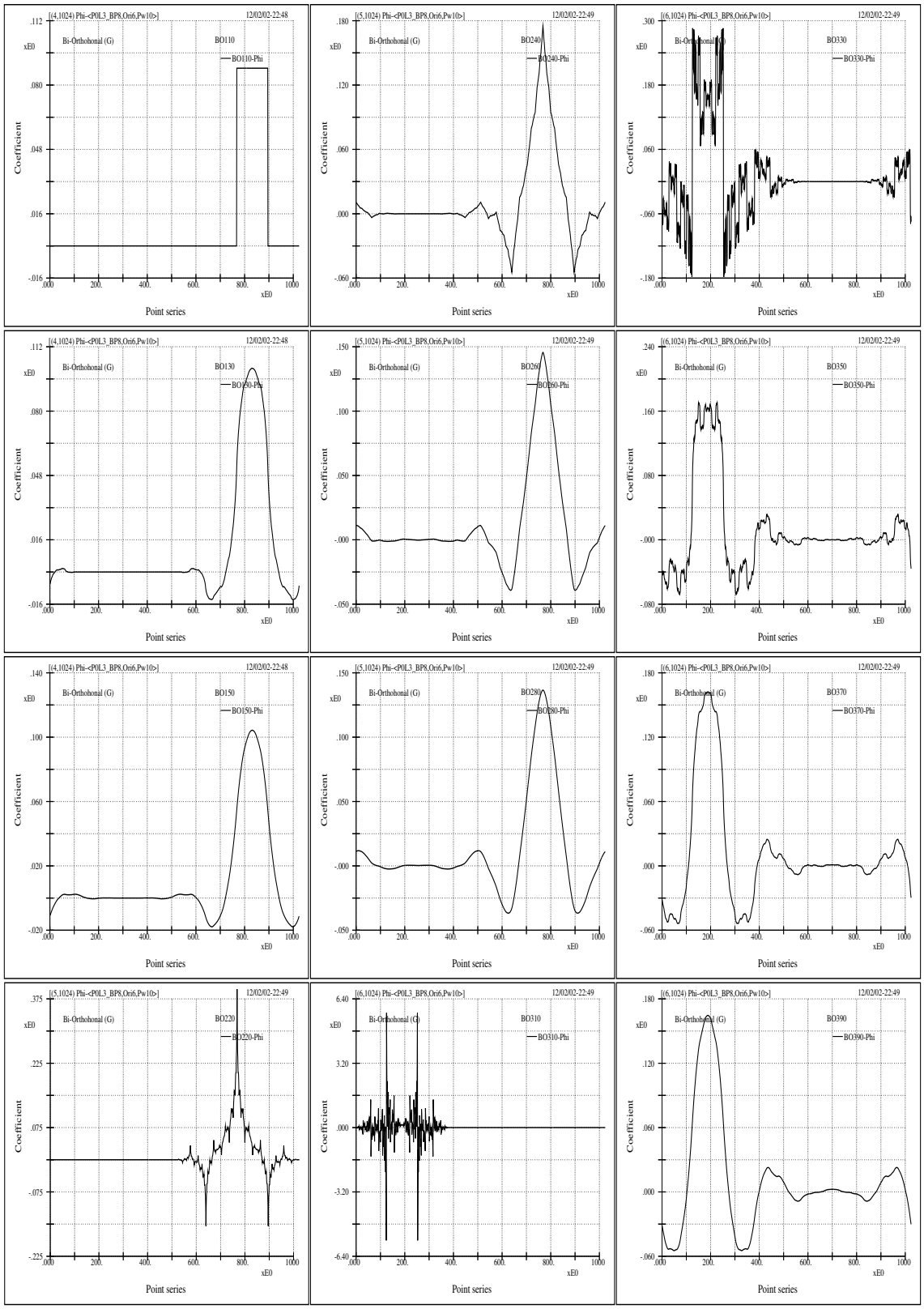


圖 2.18　交正交仔波類屬 BO*xx*O 其父仔波之波形。源起點爲 6，階位（即區隔 smooth information 與 detail information 之邊界點階位）大於 3。

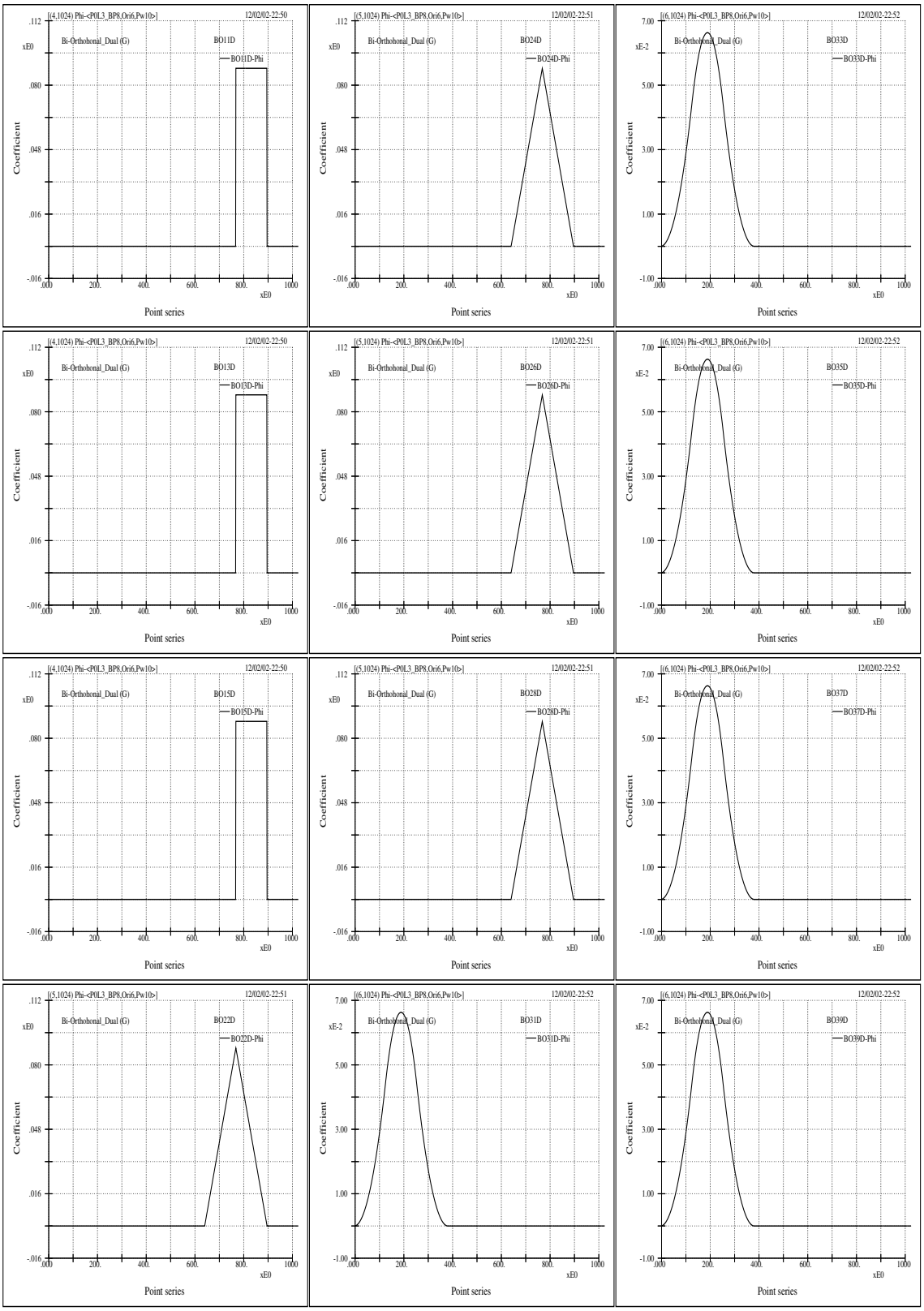


圖 2.19　交正交仔波類屬 BO*xx*D 其父仔波之波形。源起點爲 6，邊界點階位（即區隔 smooth information 與 detail information 之邊界點階位）大於 3。

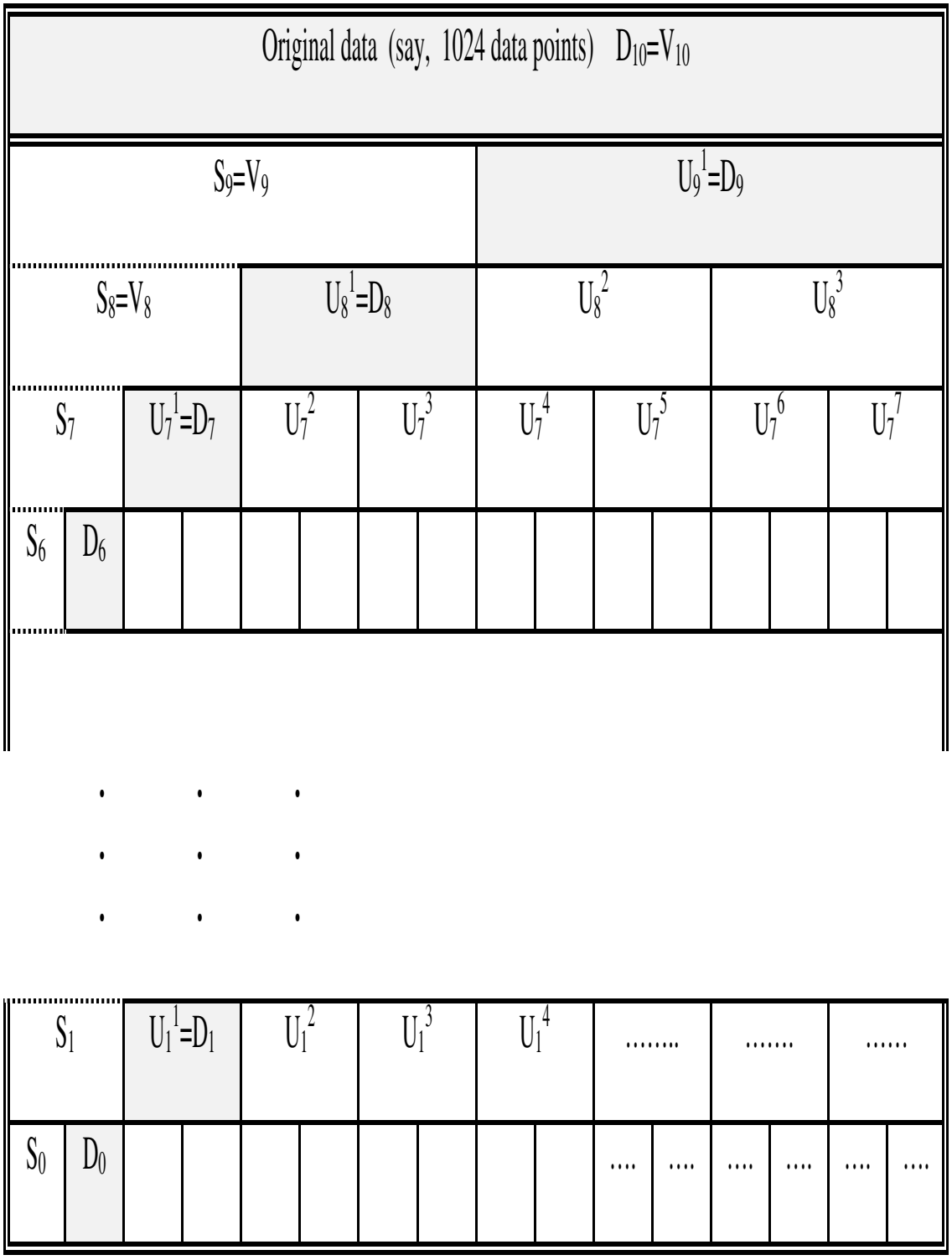


圖 2.20　仔波包轉換分解之樹狀分支結構示意圖。圖中之S（或文中之 *V*）與 D 分別表 smooth information 與 detail information。 U之上標若大於 1 則表以仔波包進一步分解。 U 之下標代表尺度階位；而 U 之上標則示該係數所發生的位置，另其位置尙依尺度下標而定。

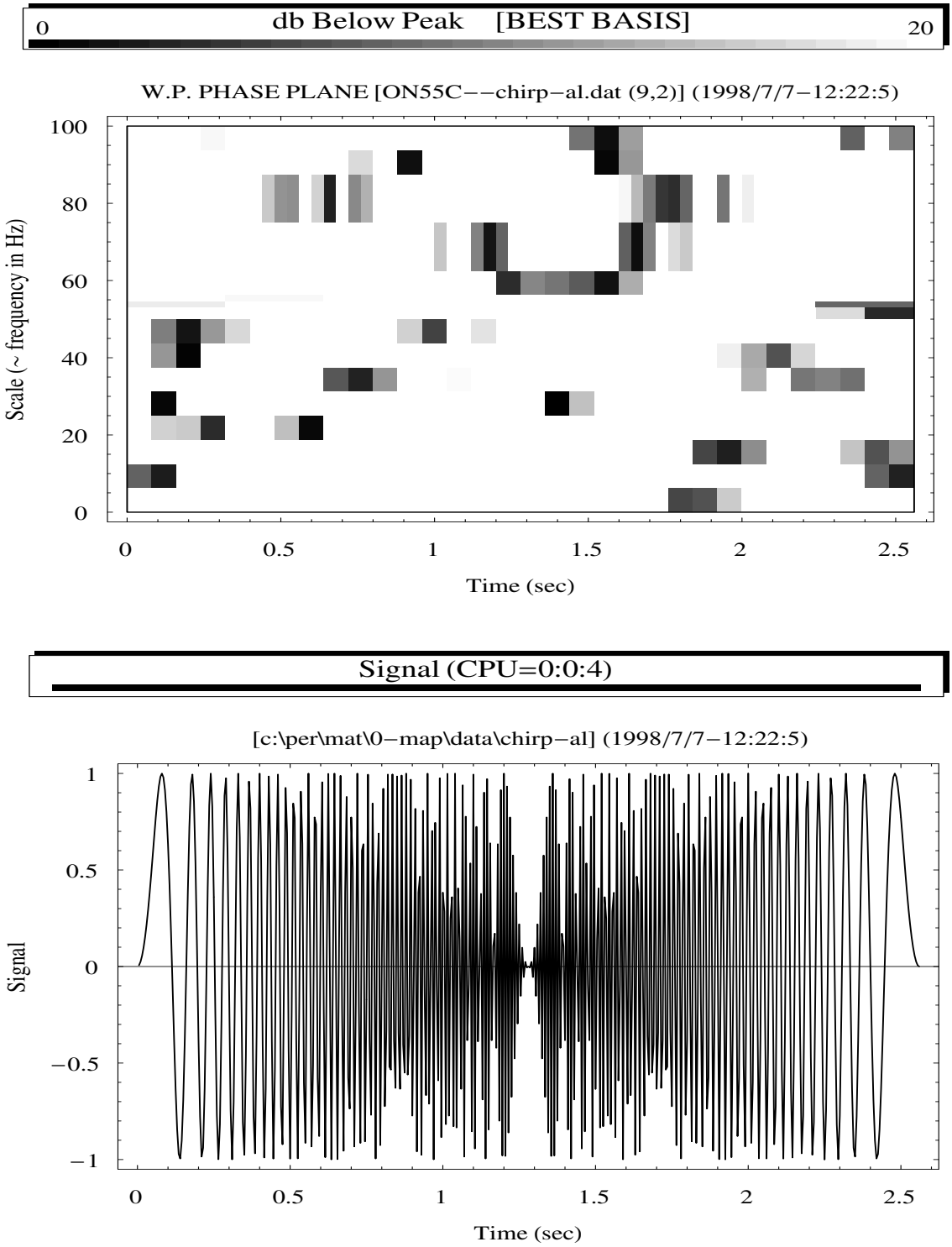


圖 2.21　仔波包轉換時頻窗相位分佈圖（上圖），此處仔波包是相應於Coiflet，另其旋移乘積權重係數個數爲 30，而所用訊號爲一線性增加漸增頻訊號（下圖），其頻率分佈由 0 至 100 Hz，此處因係非足頻取樣（即取樣率只爲 Nyquist rate 一半），故有折誤現象。此外當注意此時頻窗之非對稱分佈及多重頻帶分散性所代表轉換意涵。

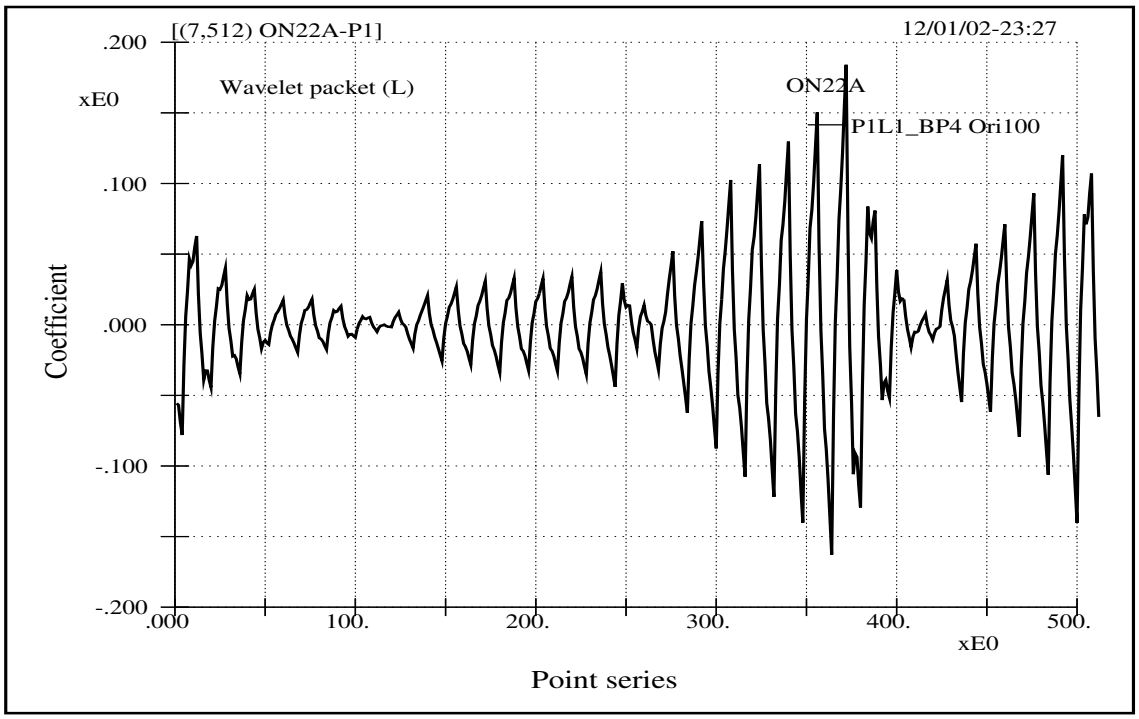


圖 2.22　相關於Daubechies ON22A 之一個仔波包波形。此圖示階位 2，邊界點 8，排序在點 100 處之源起單位係數，其所對應之仔波包波形。

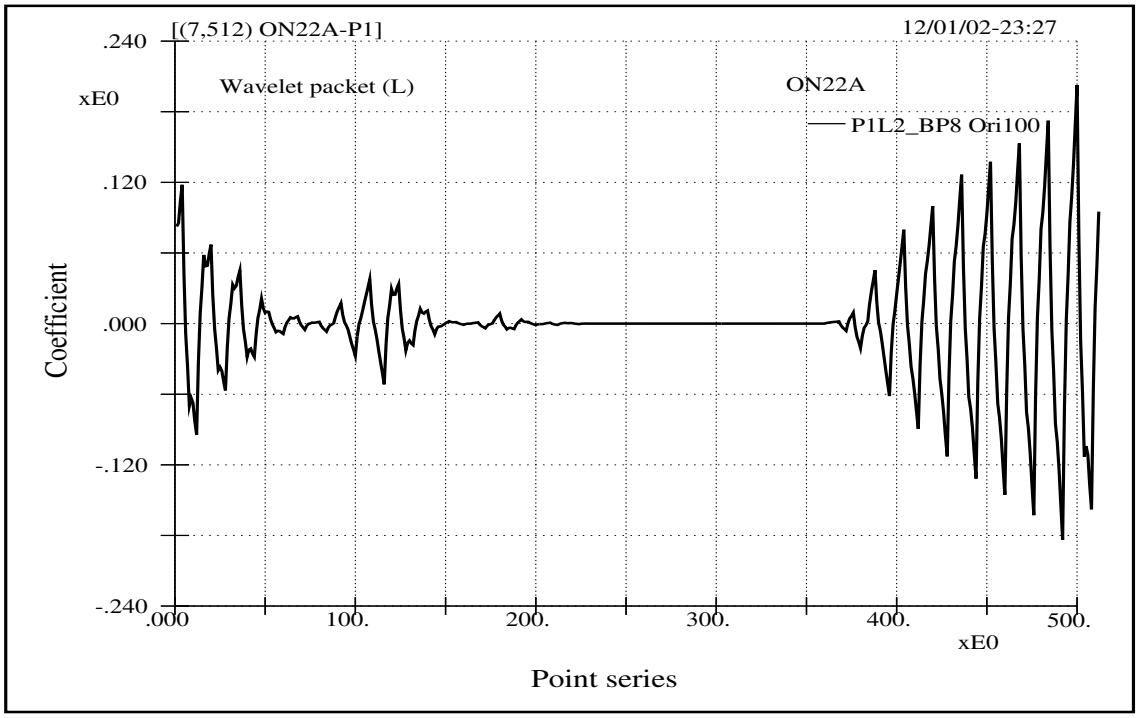


圖 2.23　相關於Daubechies ON22A 之一個仔波包波形。此圖示階位 5，邊界點 64，同樣排序在點 100 處之源起單位係數，其所對應之仔波包波形。

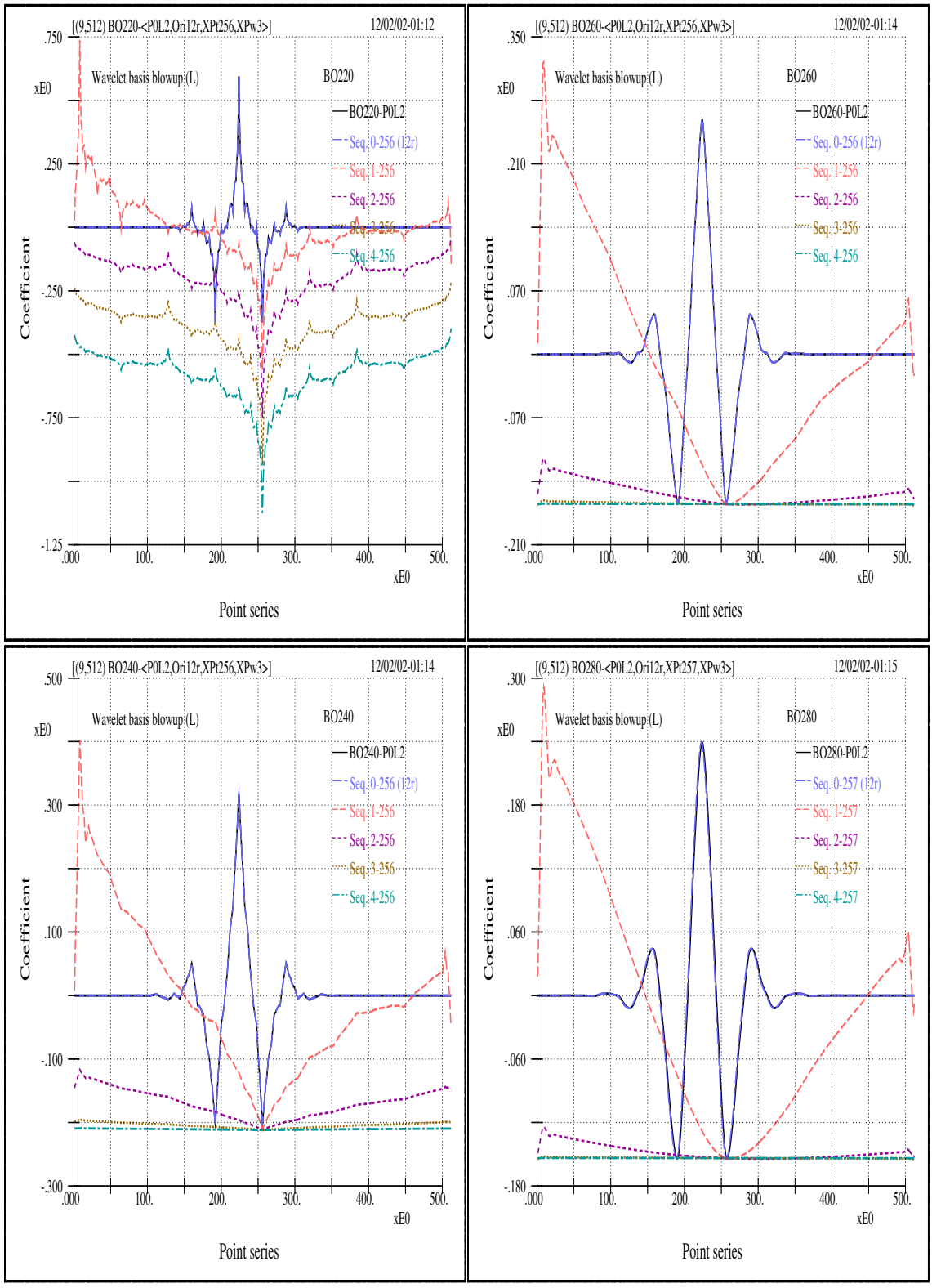


圖 2.24　一些 BO2xO 仔波之爆展圖。相鄰爆展曲線之尺度間隔是爲 2^3。仔波函數之源起點及爆展位置點皆示於各子圖中。

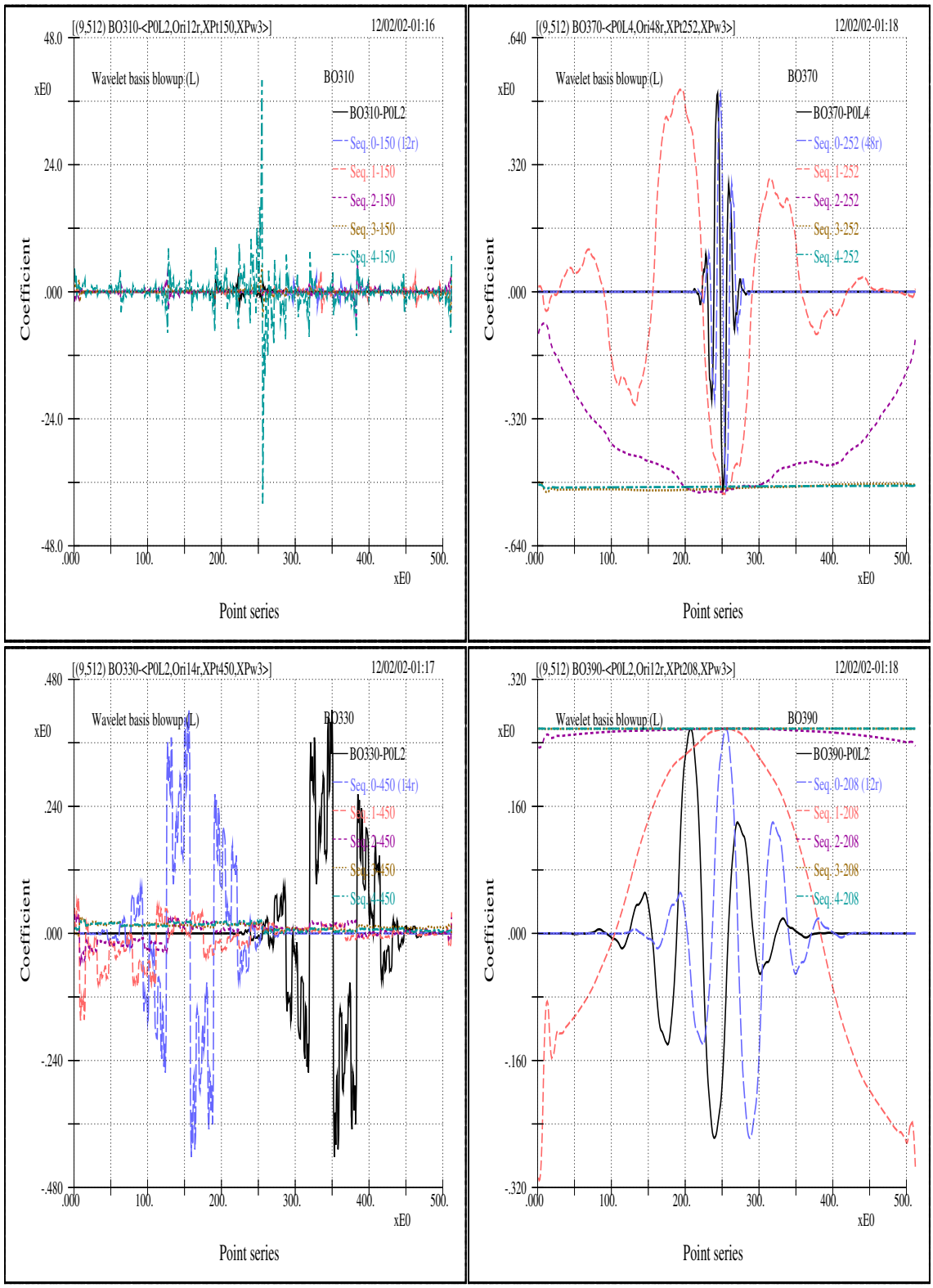


圖 2.25　一些 BO3*x*O 仔波之爆展圖。相鄰爆展曲線之尺度間隔是爲 2^3。仔波函數之源起點及爆展位置點皆示於各子圖中。實線乃表示未平移之原仔波，其餘各曲線係平移至水平軸之中心點者。

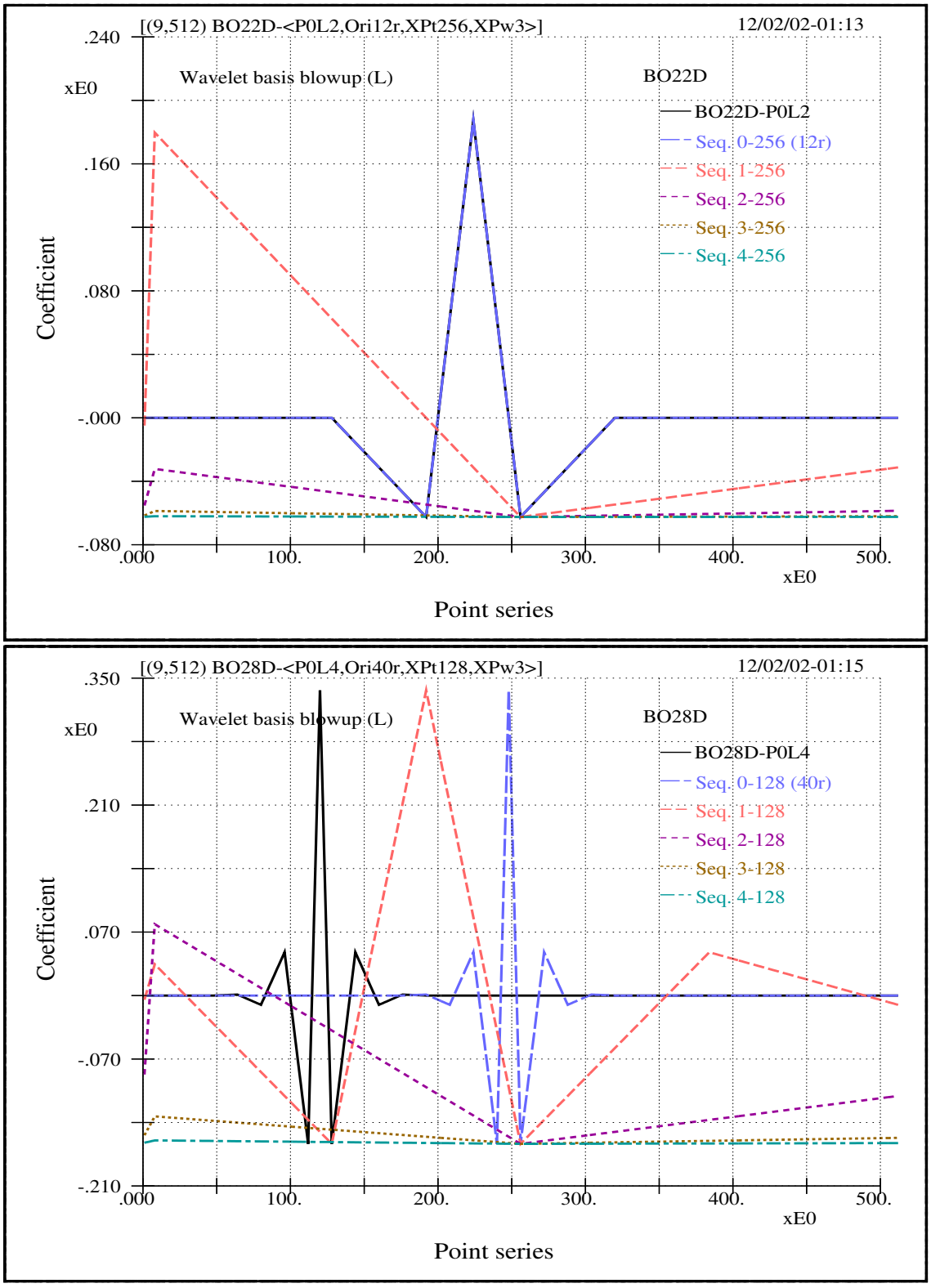


圖 2.26　一些 BO2*x*D 仔波之爆展圖。相鄰爆展曲線之尺度間隔是爲 2^3。仔波函數之源起點及爆展位置點皆示於各子圖中。

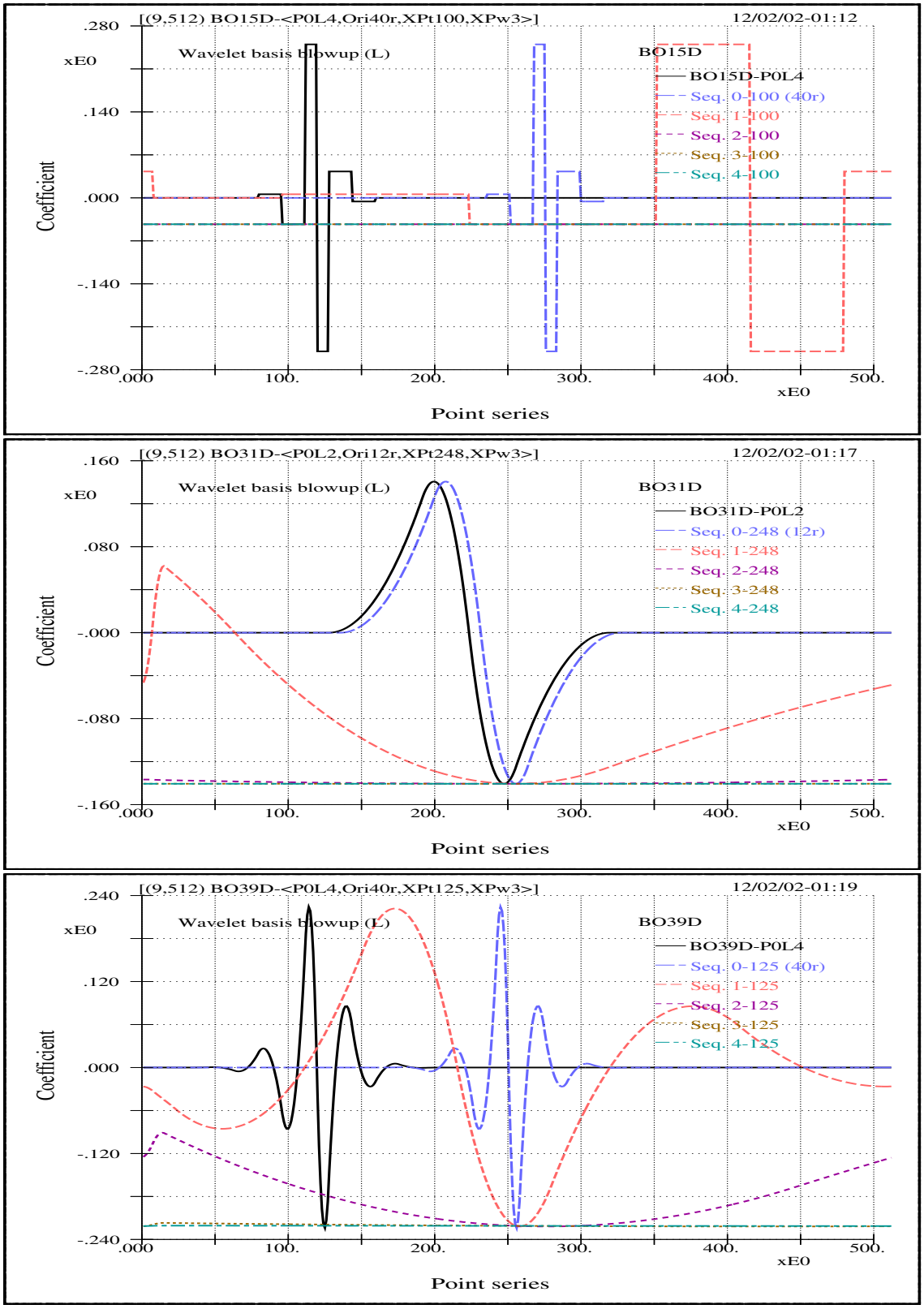


圖 2.27　一些 BOxyD 仔波之爆展圖。相鄰爆展曲線之尺度間隔是爲 2^3。仔波函數之源起點及爆展位置點皆示於各子圖中。

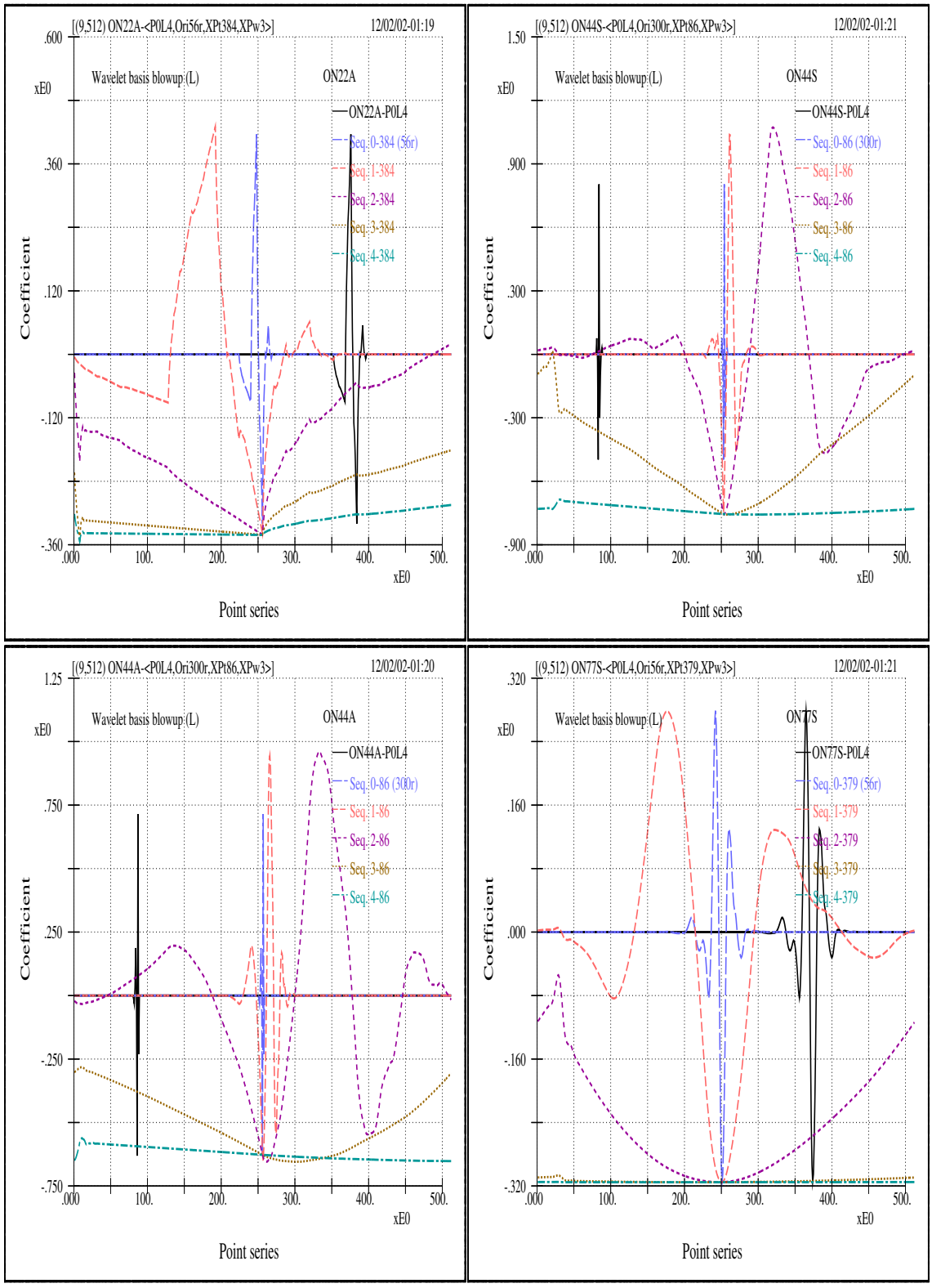


圖 2.28　一些 ON*xx*A 及 ON*xx*S 仔波之爆展圖。相鄰爆展曲線之尺度間隔是爲 2^3。仔波函數之源起點及爆展位置點皆示於各子圖中。

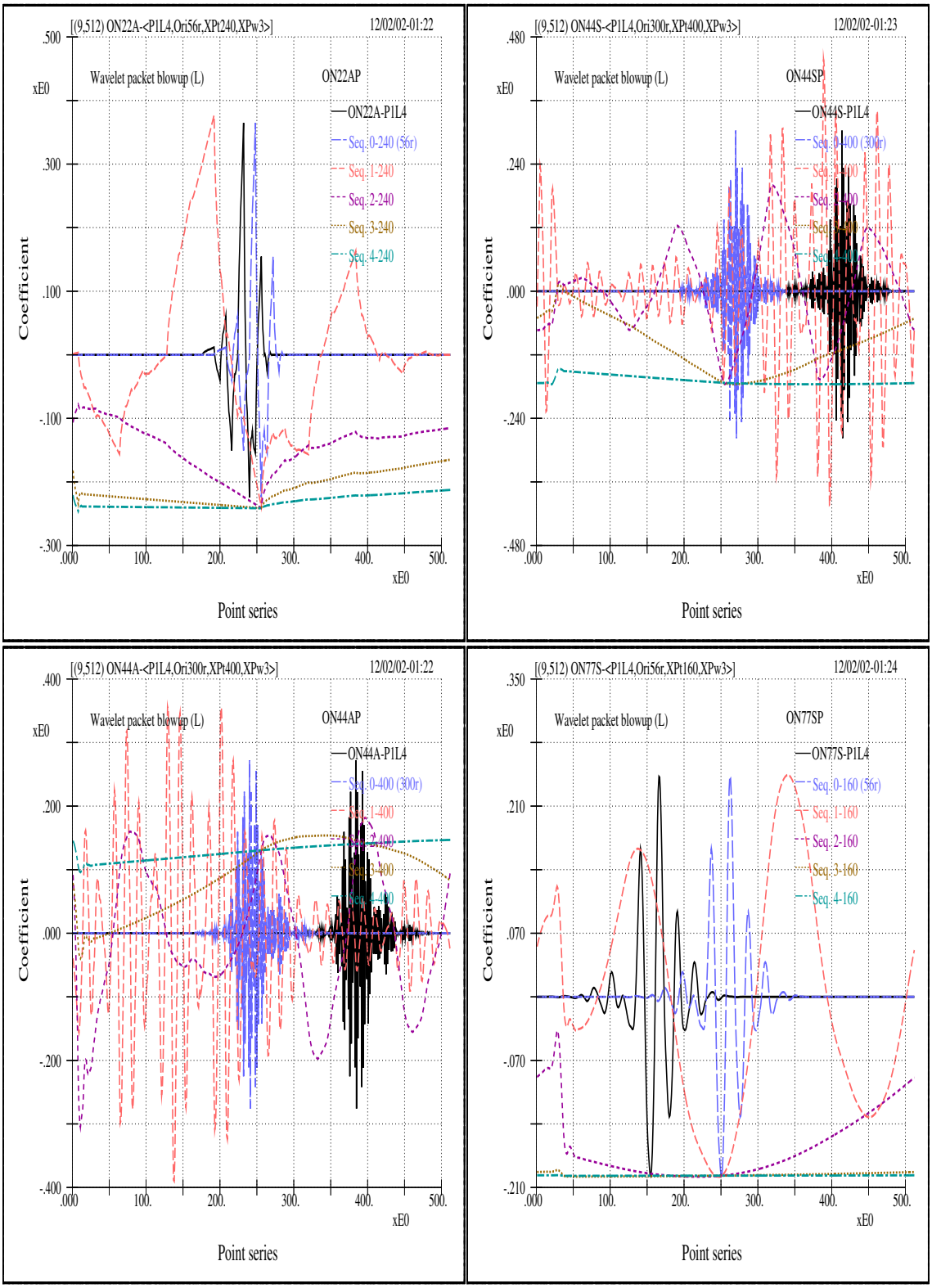


圖 2.29　一些以 ON*xx*A 及 ON*xx*S 爲源頭仔波之仔波包爆展圖。相鄰爆展曲線之尺度間隔是爲 2^3。仔波包之源起點及爆展位置點皆示於各子圖中。

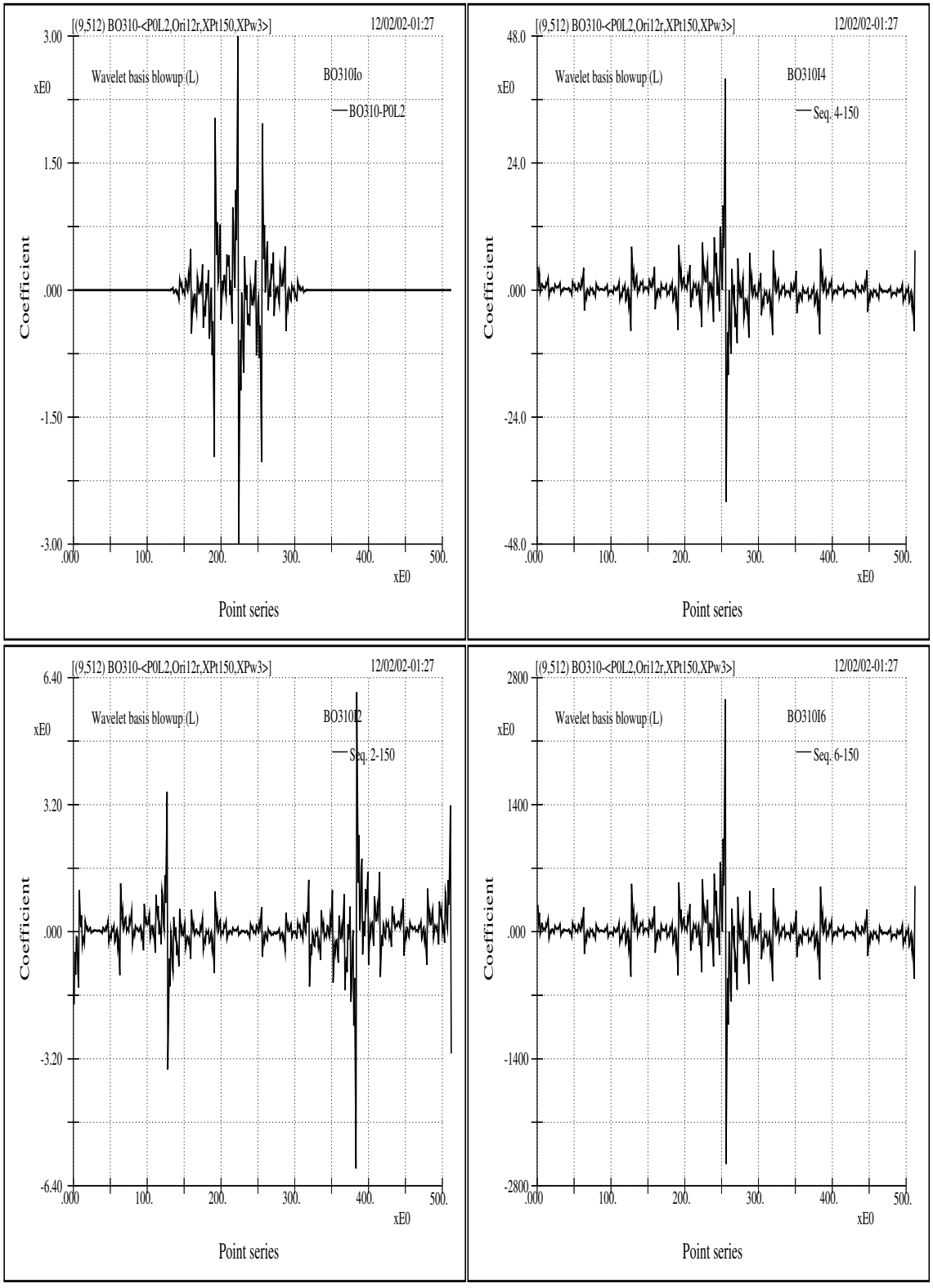


圖 2.30　BO31O 仔波之爆展圖。相鄰爆展圖之尺度間隔是爲 2^6。仔波函數之源起點及爆展位置點示於圖中。各爆展曲線之表示已平移至水平軸之中心點。

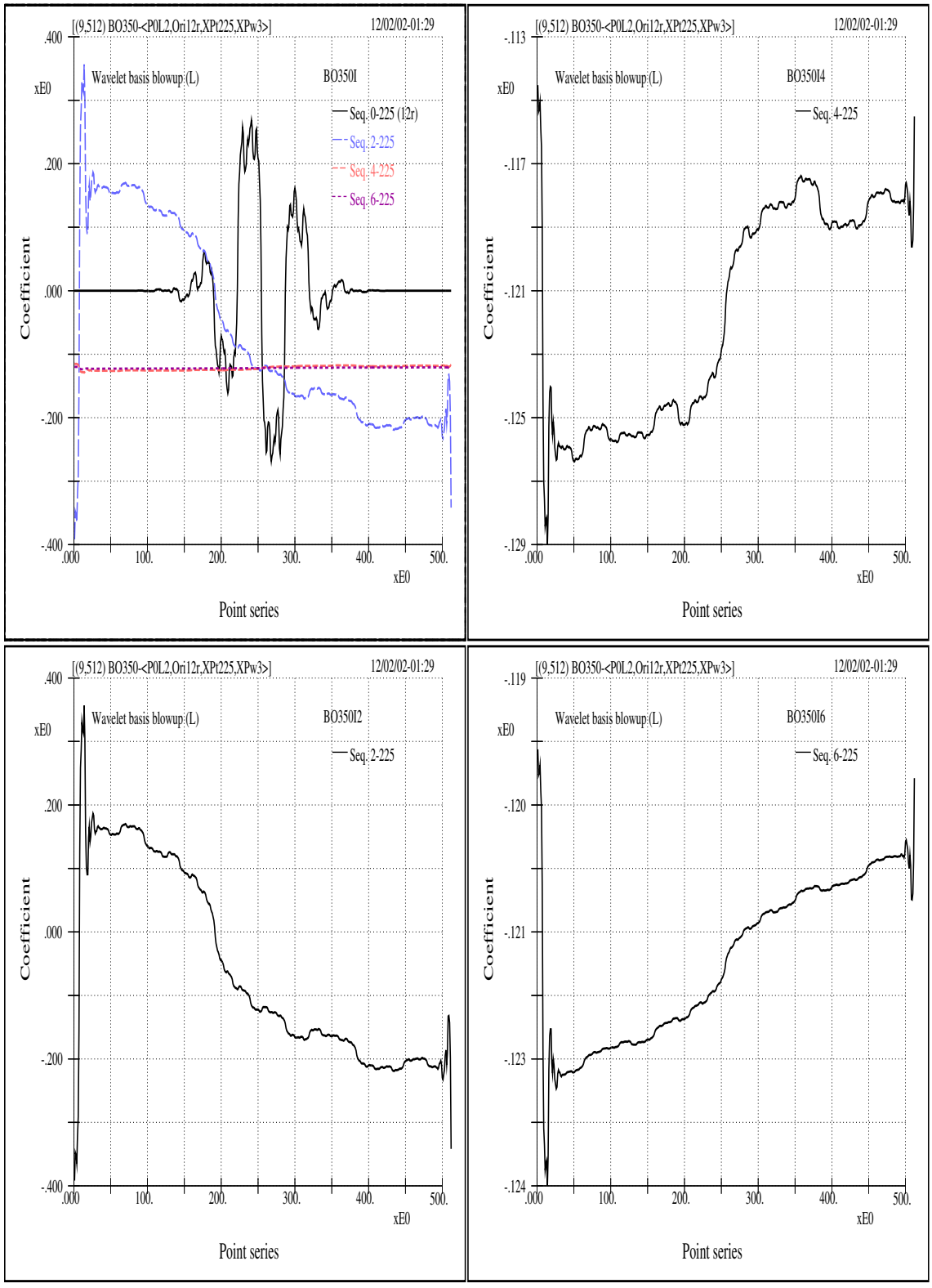


圖 2.31　BO35O 仔波之爆展圖。相鄰爆展圖之尺度間隔是爲 2^6。仔波函數之源起點及爆展位置點示於圖中。此處應留意其爆展點曲線斜率之更易。

第3章

仔波熵值與水波最佳函基

3.1 仔波數學與水波物理

以仔波來研究水波現象，最擾人、亦是最根本的問題，就在仔波之選擇基本上是無窮多的。這種問題衍生的也就是物理解說之確適性問題。每一種仔波函基都可以得到一組數據分析結果、或者一組各式之曲線分佈，也如是，如何附予義涵、或將其有義化，應是仔波分析在應用上最迫切也是最重要的核心。事實上，不解決這一關鍵，則研究不免陷於投機式分析，這種分析，說的輕一點是根基淺薄、立論薄弱、避重就輕，說的重一點是指鹿爲馬、顚倒是非。它們衍生的問題可能遠高於解決問題。因爲一個研究分析，最重要的科學精神就是在於「其可預期性」，決不能落於「人話鬼話」之譏；再者賭博行爲與統計行爲也完全是兩碼事，缺乏廣泛性、歸納性的分析即不符科學要義。

正如前述，物理解說的適切性是核心問題，而解說的運作，對水波研究而言，是屬不明確的手法及目的，因爲解說之成敗難以絕對。這一情形與一些著重數理因子或數值過程的研究課題相較而言，它們的研究重心是有極大差異。後者的物理解說要求常不明顯，然而目標則相當明確而直接，比如在資料儲存、訊號傳送、影音處理、等研究上，往往所在乎的就是，高速的分解與重組效益、最大的壓縮與儲存容量、最少的扭曲與流程步驟、等，此時研究對象其資料與各類仔波函基之間的問題，基本上是數學內涵遠超過物理要義。

從上述之觀點而言，數學內涵與物理要義其不同需求似乎是有很大的差別，而事實上對水波研究與應用來說，我們所看重的也決不是所謂的「精簡」、「效率」，我們所看重的是「性狀描述」、「物理特徵」。也如是乎，「精簡」、「效率」與「性狀描述」、「物理特徵」似乎是可以不相牽連；不過，話說回來，數學上而言，轉換之效率與精簡，卻在實質上與解析上，代表著訊號其組成成分與解析函基函數之間的相似性高低。再者，一個模擬波形如果看來就不似我們的成分波，那我們如何期待它所產生的現象能與我們的直覺認知會產生共鳴，進而帶來令人折服的物理解說呢？也如是乎，前述所言，訊號表示或模擬其數學轉換的效率與濟經性，卻也跟我們在這一不同領域上，所强調、所追尋的物理訴求有異曲同工、不謀而合之妙。亦正因如此，此處首先點明了熵值研究相關於最適函基探討之礎石階位。

所謂的熵值探討，在概念上可以視爲一種「距離量測」。這種距離是指訊號與函基之間的歧異程度。雖然此處我們並未構築任何新仔波函基，亦未對已知之仔波類型，在其參數範圍上加以延伸建構。但一者，此處所含蓋之萊斯仔波函基類屬不可不謂相當廣泛完整，再者，考量章末之各種結論，與及下一章之結果，我們可以很肯定地說：這些新建構與延伸建構是沒有必要的。另外我們亦可很明確地指出：那些具破裂自似性 [20]，或解析特性突出，或性狀新穎奇異的仔波，在水波物理應用上必然是發揮不了作用。

此處所驗証之仔波是爲前一章中所列之所有仔波及仔波包，這些二基底仔波（dyadic wavelets），其數學取樣率爲 1，對訊號取樣之離散本質而言，可說在應用上最具實際用途或物理義涵。另外我們亦將富立葉轉換函基之結果加以比較。而爲增加我們論述之肯確性，我們採用多類熵值規範，探討轉換係數其累積機率密度函數之分佈，及其熵值表現。另所取水波訊號係爲室驗室水槽中之風生水波。

3.2 各式熵值規範

熵值是統計物理的一個術語，因此它所給的是一種不帶保証的指標。熵值其比較淺顯實際的解說或相關義涵，可以視爲一個原始訊號與其重建而成的近似訊號之間的可能差異程度，這一重建訊號是以部分的轉換係數行反轉換爲之。

此處爲了避免一些研究中所帶來的那種神祕而難以瞭解的熵值意象，我們採取一種逆向處理方式，即是，首先直接說明熵值其數值求取的流程及求算公式，再回過頭來解說這樣的流程與求算公式是有那些統計與物理涵意。

設若我們有一記錄得之資料，其長度爲 1024 點，則其仔波轉換亦存在有一由 1024 個係數組成之集合 $C = \{c_i\}$，今將這些係數取其絕對值或平方值，再依其值大小排序，由 0 值以迄最大係數值，然後又將這一排序依其係數分佈範圍，劃分爲 M 個等間距轉換值之子集合，因此我們得以得知每一等區間內有多少轉換係數，即該區間之發生機率，並進而取得其正規化下之發生機率，此一機率分佈一般即稱爲「概率密度分佈」或「機率密度函數」（probability density distribution or probability density function, pdf），其是爲 $\{p_1, p_2, \cdots, p_{M-1}, p_M\}$。而熵值即是：

$$H(p) = -\sum_i p_i \log p_i . \tag{3.1}$$

式中當 $p_i = 0$ 則設爲 $0 \log 0 = 0$，此乃實質上我們可以假定在這 i 區間內其發生機率爲幾乎接近於零但不完全等於零，因而其 log 存在，而乘積可視爲零，且整個合成因係有限序列，可不受影響。再者，這整個過程的結果亦只是一種統計指標，這樣的修正對所有常規化數值也可說是完全沒有實質影響。

今若取轉換係數 c_i 之絕對值爲之， $H(p)$ 則是爲 L^1-norm 熵值，而若取轉換係數之平方值爲之，則是爲 L^2-norm 熵值。當然其它之冪次也可以取之研究，但最具代表性的還是一、二次方的熵值， L^1-norm 一次方者具幅度義涵， L^2-norm 二次方者具能量義涵，這兩者可說已含蓋了絕大多數物理解說對象。

以上說明了熵值求算是爲機率密度分佈之統計參數，接下來，就來說明這一參數定義有何實際表徵或物理含意。

設若兩個機率密度分佈函數爲 p 與 q，而其轉換係數排序爲由大而小降減者，則若 p 之降減現象較 q 之降減來得快，則 $H(p) \leq H(q)$ [25]。上式熵值不等式之成立是爲單向正確，反向論述則未必成立。這也就是我們說，熵值是一不帶保証之統計指標之由來之一。而所謂的指標即是：較小之熵值代表著更多能量是儲存在更少數目的轉換係數當中。也如是乎，設若我們只保留某一固定百分比之較大轉換係數，而捨去其餘較小係數，則如此產生的捨去誤差，即表示其與全部轉換係數總合成之距離。而就關聯於此之熵值表現而言，較小熵值也就代表著這種捨去誤差所映射的距離是較爲縮小。

另外還有一種熵值統計表示法，或被稱爲幾何概念法 [25]。實際上，這一表示法是前一方法的一體兩面，可謂換湯不換藥。同樣地，此處先說明實際數值作業流程，再回過頭來加以物理解說。今設若我們將排序後之間距區隔數目取相同於轉換係數之數目，並將機率密度分佈函數定義爲仔波轉換係數之平方值，並以所有全部能量爲據，加以正規化之，亦即全部能量爲 $\|C\|^2 = \sum_i |c_i|^2$，而個別機率密度爲 $p_i = |c_i|^2/\|C\|^2$。此時將 p_i 代入方程式 3.1 中可得熵值爲：

$$H(p) = \log \|C\|^2 - \frac{\sum_i |c_i|^2 \log |c_i|^2}{\|C\|^2} \tag{3.2}$$

這裡的概念其實是很簡單的：如果把對低能量係數給予更多的權重，而高能量係數給更小權重，則此一加權的能量是可爲熵值的一種指標，因爲將一個數值取對數是爲一種加權的動作（所有的係數已正規化處理，故均小於 1），且因整體能量是爲固定值，是故較小熵值代表著那些能量高而顯著的轉換係數之數目數較少，也就是說，更多的能量是集中於較少的轉換係數群中。與上一種定義之說明比較，得見兩者之近似含義。

另一熵值指標可以下式表示

$$D(p) = e^{H(p)} = \prod_i \left(p_i^{-p_i} \right). \tag{3.3}$$

此 $D(p)$ 一般稱之爲理論維度 [25]。其乃將 3.1 式直接置於指數之冪次而得，式中 $\prod_i$ 爲連乘運作。

雖然熵值是一種數值統計指標，其推論是基於對式中因與果之反向運作，因而有其不確定性，但由我們所得諸多數值結果的表現行爲與明顯趨勢，我們可以肯定地表示，我們對所下之判定有充足的信心。

3.3 熵值結果與水波最佳仔波函基

爲了增進比較之明確性與肯定度，我們計算數種設定下的熵值：以基於式 3.3 並取 L^2-norm 之直接係數熵值（表 3.1 與 3.2 中之第一欄）；以 L^2-norm 爲計價值，並劃分成 300 個區隔之 pdf 熵值（第二欄）；以 L^1-norm 爲計價值，並劃分成 300 個區隔之 pdf 熵值（第三欄）；以 L^2-norm 爲計價值，並劃分成 200 個區隔之 pdf 熵值（第四欄）；最後一欄（第五欄）是爲理論維度熵值。這裡我們所用的水波訊號係爲實驗室水槽風生水波。此處補充說明的是，如果選用不同訊號，而其主頻（或主要能量尺度）有明顯不同，則爲讓熵值比較有較一致性條件，則所分析之訊號長度及其取樣頻率應該依據其主頻或尺主度作適當調整。這是因爲仔波轉換下我們需要對移位大小有實質概念，才得以對仔波波形大小有較眞切的體會，另一方面，也因爲不像富立葉轉換下，其單位很容易具體化成頻率，仔波轉換下，其縮放尺度則無因次而造成相當模糊。

表 3.1 示所有正交仔波（含 B&L、Meyer、ONxxA、ONxxS、ONxxC），半正交仔波（含 SO3O、SO3D），以及富立葉波譜之結果，表 3.2 則示所有交正交仔波之結果。由這些數據，我們可以取得一些非常明確的特徵，並作一些相當肯定的推論，茲列述如下：

- 若匹配仔波存在，則匹配仔波與相對應之原仔波比較起來，以匹配仔波爲轉換函基（原仔波出現於內積中，即表中的 SOO 與 BOxyO）所得之熵值必然是明顯大於以原仔波爲轉換函基（匹配仔波出現於內積中，即表中的 SOD 與 BOxyD）所得之熵值。換句話說，對水波浪研究而言，使用如下的方程

式

$$f(t) = \sum_{j,k} \langle f, \widetilde{\psi}_{j,k} \rangle \psi_{j,k} \tag{3.4}$$

其效率性與近似性是必然優於下面另一解構方式

$$f(t) = \sum_{j,k} \langle f, \psi_{j,k} \rangle \widetilde{\psi}_{j,k} \tag{3.5}$$

也因此我們可以很明確地指出：針對存在有匹配仔波之半正交類屬及交正交類屬，無論是要探討物理、亦或針對數值計算效率、或者是水波訊號之解構或重建，我們的選擇函基必然是原仔波，而其而其轉換係數求算之投射機制則以匹配仔波運作。

- 檢視那些 x 、y 值較小的交正交仔波（BOxyO 與 BOxyD），可以發現它們的熵值皆比 x 、y 值較大下之熵值來得大，再審視這些仔波形狀之特異性（圖 2.30 與 2.31），得以實質上說明的是，這些具明顯破裂自似性之仔波是非常難以眞實的。

- 就交正交仔波而言，可以由其熵值表現看的出來，完全沒有必要再擴展或延伸其仔波建構之支撐長度，亦即針對 x、y 加以擴充是無法帶來改善的・這一點可以下面三個因子加以論定。其一，若 x 不變，增加 y 時，因 y 越大它所對應的匹配仔波波形可說幾無影響，或說是見不到改變性；其二，無論解構或重建，都是要以匹配仔波作爲內積運作函數才得有較小熵值，也如是乎，此一延伸必然沒有多少助益；其三，交正交仔波其函基函數之構築基核係以樞點順適函數爲之，而樞點順適函數其樞點數增加到某些數值時，我們也就很難看出那些樞點順適函數在形狀上有何差別。綜此，可以肯定地說，對此類函基之延伸建構是沒必要的。

- 所有正交類屬及其子類屬之熵值行爲，都無法降到非正交類屬及其子類屬之較小熵值表現。此外，正交類屬其仔波支撐長度之大小對熵值表現也幾無明顯效應，雖然較長支撐長度之熵值似乎會比較短支撐者者有些微統計改善，

但其影響卻可忽略。再者，這一類屬之所有熵值都分佈於狹小區間，因而我們實在難以預期這一類屬在水波應用上會有任何特出表現。此外在下一章裡，我們將說明線性相位濾波與這一熵值表現之關聯。

- 所有正交類屬之仔波中，沒有一個具有突出之表現，此外，在任一子類屬中也看不出有任何熵值表現趨勢。這些說明了，很多數學上不同的解析特性，在理論上雖有絕大之差異或重要性，但對於我們水波模擬上之有義化或物理實用性，則可說是難有些許作用。比如說，Meyer 仔波在解析上是無窮可微或無限光滑，而 B&L 仔波則是二階可微，而其它仔波亦存在有各自的可微性與規則度，但各種熵值表現都難以區別。

- 最突出的結果，也是最令人驚奇的是，最小的熵值表現是出現在樞點順適仔波之轉換函基（即以其匹配仔波行內積運作之係數求取），其各種熵值明顯遠較其它函基之各種熵值爲小。再者，令人訝異的是，其熵值也都比用富立葉波譜函基所得熵值來得小。此一結果，實際上已指出：應用半正交仔波求取得之轉換係數，較諸用富立葉函基所得之轉換係數，不論在訊號模擬、物理解說、應用探討、等等，必有其潛能及優越性。

3.4 熵值與累積機率分佈曲線

此處我們再對一些函基其轉換係數累積機率分佈曲線加以比較，這些比較得以進一步說明樞點順適仔波所存在的優越性，另一方面得以對仔波包之熵值結果與預期表現，加以確切論定。圖 3.1 係多種仔波其累積機率分佈曲線比較圖。而前節中，所謂讓人訝異的結果，正是反應在代表樞點順適匹配仔波之曲線走勢。這一走勢，在大部分的範圍，都是平坦（或水平）的，可說是幾達百分之九十之範圍是平的，此後才揚升，且其平坦性亦較波譜函基所得者明顯，而在能量比達百分之九十六時與代表波譜函基所得之曲線交會。此一結果說明了，用最少的轉換係數即能代表水波訊號。

接著，爲實際領受樞點順適仔波之優異行爲，我們以實際重建訊號來比較，此處取熵值表現最佳、亦最接近之兩者，即樞點順適仔波及富立葉函基爲之。圖 3.2 示一段重建訊號與原訊號之比較。圖中之上子圖係原訊號，中子圖係相關於富立葉函基之重建訊號，下子圖則相關於樞點順適仔波者，而重建反轉換所用的轉換係數量係保留總量之百分之三十五。由圖可見，樞點順適仔波所重建之波形更接近於原波形，特別在是微小局部之曲線，大底均較眞切。

針對樞點順適仔波所表現的優異性，其相應於水波特性之表現所相關的現象因子，我們可以從 Chui [2] 對此一仔波之詳細研究中發掘。此處指出，其乃樞點順適仔波所特別具有的二個特性，即「全振性」與「全正性」。所謂的「全振性」是指母仔波函基函數具有完整的擺盪性，而沒有一些沒必要的中間起伏波動，或者說是所有波動都是越零位之波動；而所謂的「全正性」，則是指其父仔波的曲線分佈都是正值分佈而沒負的。而此處我們要指出的是，這兩種特性，在物理義涵與實際應用上，在在表明我們的試驗水波其時變性對絕大多數之仔波而言，其變動都是相對非常柔順的。此外，其亦提示著，適當支撐長度、或者是適當生命週期的函基函數，是比較可能產生有義化之物理解說。

至於仔波包轉換係數之類屬，主要的兩種取法是爲：最適函基與最適階位函基。事實上我們很容易地可以推論到，任何組合之仔波包函基，其熵值表現都不可能有令人滿意之結果，也必然跟樞點順適仔波之表現有相當大的差距。這一推論的立足點是明顯淺易的。因爲仔波包轉換是僅能相關於正交仔波，它的初始使用函基是正交，而後續分解所用函基亦是正交，基於前述正交類屬函基之表現，我們所能期待的自是不多。這些推論我們亦可以累積機率分佈曲線之性狀驗証之。圖 3.1 之下子圖示以B&L 及Meyer 仔波爲仔波包轉換之累積機率分佈曲線，其轉換之起始與後續轉換函基均係使用相同函基。與上子圖比較起來，這兩曲線都與樞點順適仔波者或富立葉函基者有明顯差距，不過，我們亦可看得，它們與 B&L 及 Meyer 之一般正規仔波轉換（非 WP）所得之曲線比起來，其走勢是比較平坦一些。

圖 3.3 再示相關於 ON77S 之累積機率分佈曲線，包含正規轉換、仔波包最適函基、仔波包最佳階位函基、不同階位函基轉換者。由圖可見，仔波包最適函基之

曲線其表現最佳，而最佳階位之曲線其走勢稍高，而原仔波函基之曲線則又高於此兩曲線。再者，吾人亦可從前圖中，明顯比較出，此圖所有曲線之表現與前圖樞點順適仔波之表現仍有相當大的差距。

就有限支撐長度之正交仔波而言，其函基函數不存在對稱的波形，但不同子類屬有不同的對稱性（亦或非對稱性），不過，我們對其熵值表現實在難以看出有何差異、或任何趨勢。至於那些具有對稱或反對稱的仔波函數，如半正交與交正交仔波者，其所得熵值（針對以匹配仔波函數用於內積之轉換係數求取）則相對明顯來的小。此一特性，再加上前述之「全振性」與「全正性」說明，給予我們强烈的數理與物理義涵。在數理解析上，它所關聯的是波濾係數所涉之線性相位濾波；在物理含義上，它對我們於水波模擬所生視覺、亦或自覺性的障礙有絕大關係。圖 2.21 實際上是可說明了這一狀況，圖中原訊號之頻率分佈是一直線漸高頻，在一半 Nyquist 取樣頻率下，折誤成對稱山字形，而其仔波包轉換所得係數所代表時頻窗之分佈情況是爲上子圖，此圖所生之視覺障礙，應足以令人體會此處所言之數理與物理相關性。此外可以說明的是，雖然對稱性是重要條件，但仍然還有一些必需考慮的因子，如支撐長度、規則度、全振性、全正性等。如 B&L 及 Meyer 仔波都是對稱的，但它們的熵值跟正交類屬者幾無差異。

此處熵值相關 Asyst 程式爲

- `S_Ent.shl` ➲
- `LLet-Ent.asy` ➲
- `S_Ent.shl` ➲
- `LLet-Nor.asy` ➲ ❖

表 3.1　正交與半正交仔波類屬其轉換係數之各類熵值，另外亦包含富立葉函基之轉換係數相應熵值。

Wavelet	L**2 coefficient entropy (0 division)	L**2 probability entropy (300 divisions)	L**1 probability entropy (300 divisions)	L**2 probability entropy (200 divisions)	Theotetical dimension (L**2 300 divisions)
B&L	4.691	1.330	3.417	1.179	3.782
Meyer	4.647	1.294	3.365	1.132	3.646
SO3O	4.833	1.669	3.756	1.488	5.307
SO3D	1.823	0.219	1.306	0.172	1.245
Spectrum	2.809	0.270	3.044	0.244	1.310
ON22A	4.993	1.761	3.891	1.516	5.815
ON33A	4.773	1.384	3.499	1.225	3.975
ON44A	4.790	1.517	3.596	1.363	4.559
ON55A	4.819	1.553	3.631	1.367	4.727
ON66A	4.790	1.373	3.456	1.203	3.946
ON77A	4.675	1.355	3.461	1.203	3.877
ON88A	4.645	1.229	3.283	1.082	3.418
ON99A	4.719	1.412	3.501	1.252	4.106
ON00A	4.787	1.423	3.511	1.244	4.149
ON44S	4.835	1.461	3.557	1.281	4.311
ON55S	4.758	1.492	3.576	1.298	4.426
ON66S	4.754	1.402	3.501	1.225	4.065
ON77S	4.751	1.336	3.331	1.188	3.804
ON88S	4.714	1.366	3.481	1.224	3.918
ON99S	4.755	1.469	3.570	1.288	4.345
ON00S	4.635	1.278	3.378	1.134	3.591
ON11C	4.938	1.696	3.832	1.457	5.452
ON22C	4.827	1.468	3.520	1.284	4.342
ON33C	4.756	1.488	3.573	1.333	4.427
ON44C	4.690	1.297	3.337	1.157	3.658
ON55C	4.644	1.309	3.405	1.154	3.703

表 3.2　交正交仔波類屬其轉換係數之各類熵值。

Wavelet	L**2 coefficient entropy (0 division)	L**2 probability entropy (300 divisions)	L**1 probability entropy (300 divisions)	L**2 probability entropy (200 divisions)	Theoretical dimension (L**2 300 divisions)
BO11O	5.395	2.623	4.502	2.299	13.777
BO11D	5.395	2.623	4.502	2.299	13.777
BO13O	4.943	1.806	3.883	1.627	6.084
BO13D	5.266	2.371	4.373	2.053	10.708
BO15O	4.866	1.678	3.755	1.495	5.357
BO15D	5.227	2.291	4.327	1.987	9.882
BO22O	5.282	2.362	4.363	2.083	10.609
BO22D	4.434	1.181	3.284	1.034	3.257
BO24O	4.963	1.862	3.985	1.634	6.438
BO24D	4.359	1.090	3.220	0.962	2.975
BO26O	4.881	1.703	3.835	1.492	5.490
BO26D	4.332	1.064	3.174	0.940	2.899
BO28O	4.857	1.624	3.782	1.452	5.073
BO28D	4.318	1.069	3.157	0.941	2.914
BO31O	5.824	3.174	4.741	2.835	23.894
BO31D	4.377	1.058	2.655	0.936	2.880
BO33O	5.084	2.001	4.062	1.756	7.393
BO33D	4.205	1.102	2.827	0.965	3.011
BO35O	4.850	1.697	3.847	1.506	5.457
BO35D	4.125	1.026	2.776	0.908	2.789
BO37O	4.790	1.658	3.821	1.442	5.247
BO37D	4.106	0.986	2.737	0.873	2.679
BO39O	4.776	1.660	3.835	1.432	5.258
BO39D	4.098	0.967	2.713	0.866	2.629

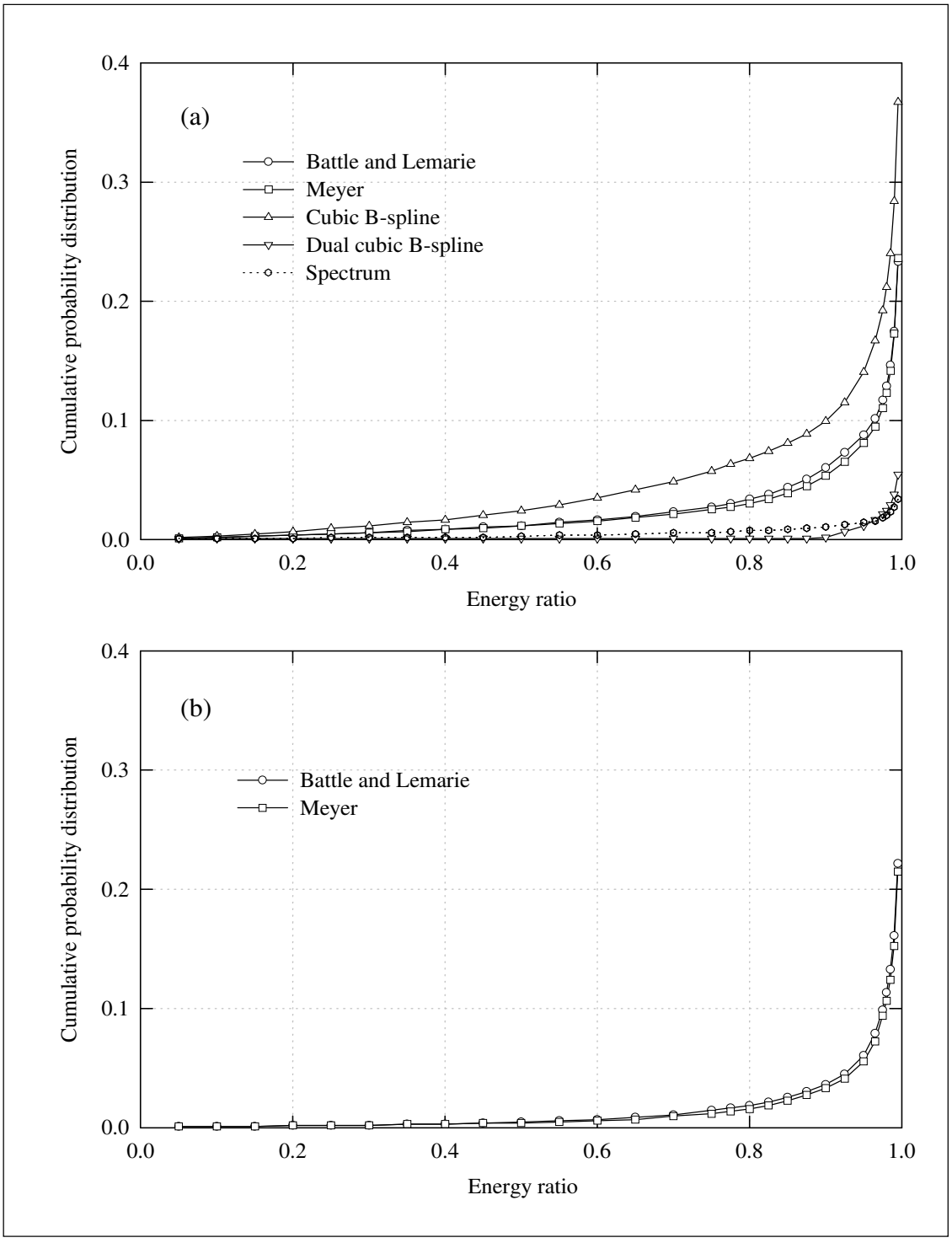


圖 3.1　轉換係數之累積機率密度分佈曲線圖。此處包含有四種函基轉換類型：仔波函基、匹配仔波函基、仔波包函基、富立葉函基。所用各函基母仔波如圖所標示。上子圖示仔波函基、匹配仔波函基及富立葉函基分佈曲線；下子圖示仔波包函基分佈曲線，其轉換係數規範係取用仔波包最適函基。

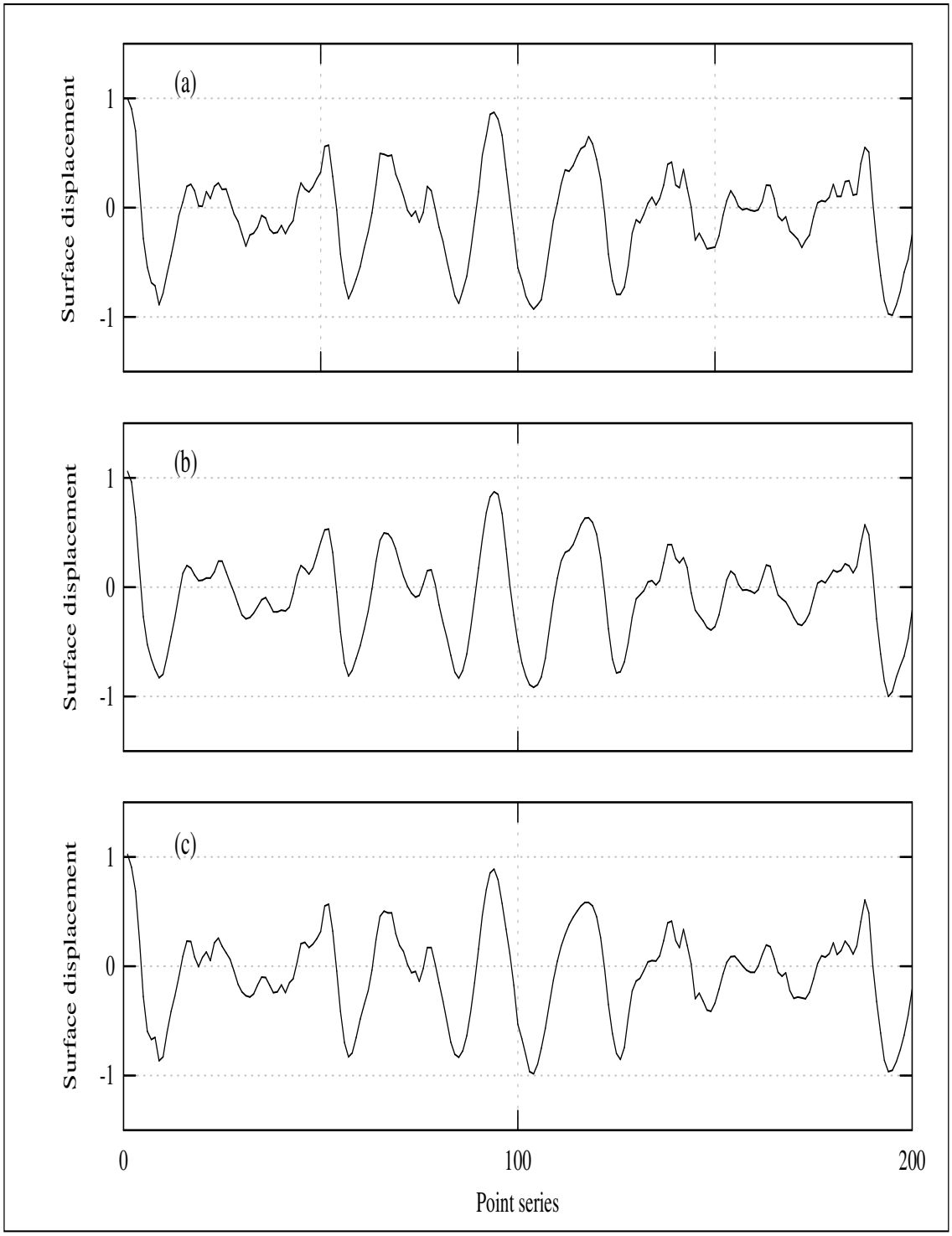


圖 3.2　以部分轉換係數所得之重建訊號與原始訊號比較圖。其重建訊號係取用 35% 的最大轉換係數行反轉換而得。上子圖示原始訊號；中子圖示以波譜係數所得；下子圖乃是以半正交樞點順適仔波轉換係數所得。由圖可見半正交樞點順適仔波提供整體最佳近似，特別是在小尺度之模擬。

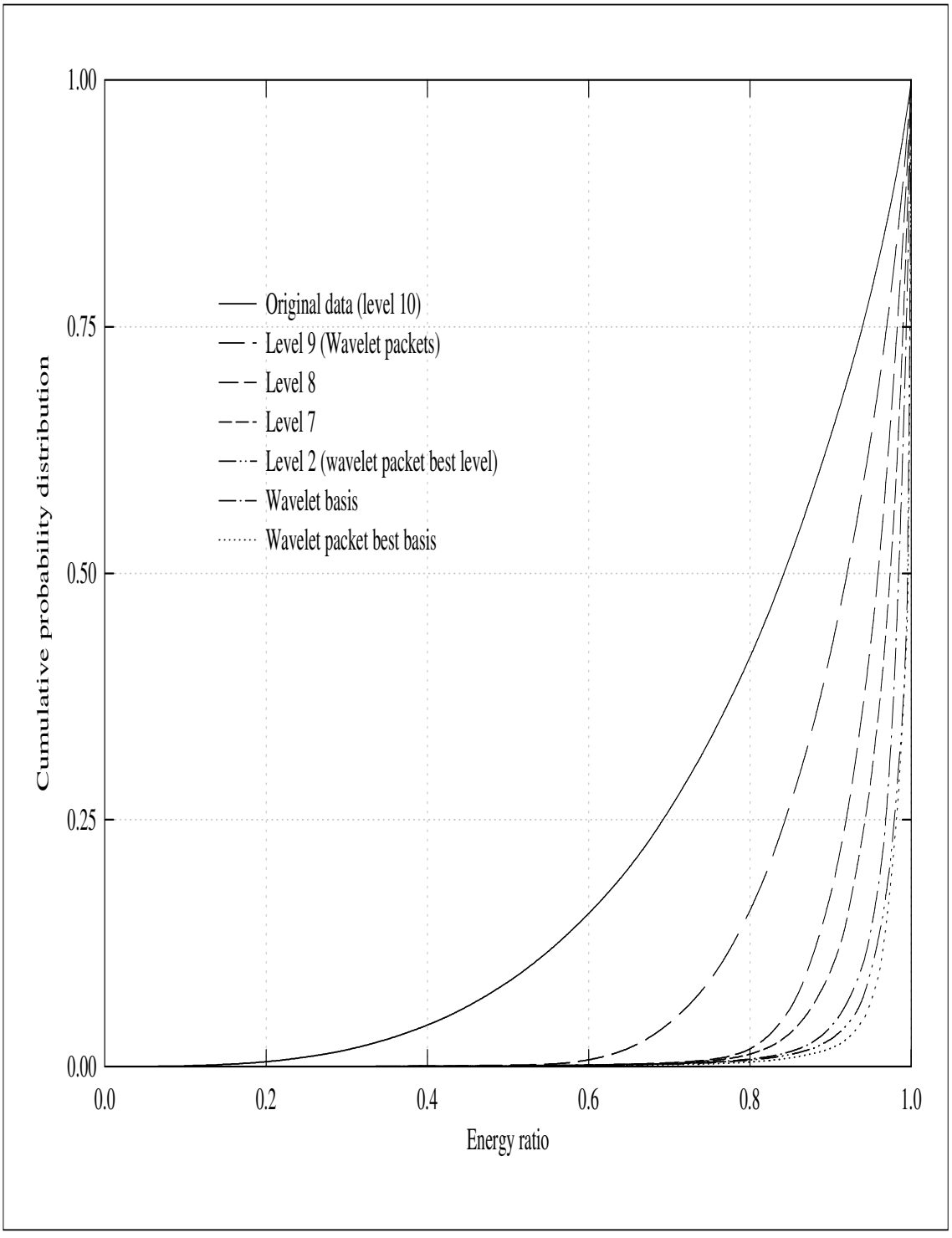


圖 3.3　仔波及不同仔波包轉換係數累積機率密度分佈曲線。其係以 L^2-norm，即能量，大小排序後之累積機率密度分佈曲線。這些函基有：仔波包最適函基、仔波包最適階位函基、仔波包不同階位函基、仔波正規函基。而所有轉換函基都源自於同一母仔波 ON77S。

第4章

仔波基核特性函數相位分佈

4.1 仔波基核特性函數

在上一章中，我們經由轉換係數之熵值表現，由諸多的仔波類屬函基暨富立葉函基中，鑑取得水波訊號模擬之最適函基是爲半正交類型之樞點順適仔波。然而熵值現象是統計手法，基本上，它在模擬近似上是有明顯的物理義涵，但它完全未直接觸及函基之數學內涵或解析本質。也就是說，熵值是函基函數與訊號成分波相似性的一種指標，然而這種相似性之良劣顯然也應該跟某些數學解析因子有所關聯。在前些章裡，我們基本上所指出或明顯看得出來的，大底是負面相關的解析因子，亦即是那些爲對熵值帶來不利表現之因子，在這一章中，我們所尋求的，將是何種解析因子是正面效應的產生者。此處將藉由對仔波函基設計所相關的基核特性函數加以探討，尋求相關於水波實際應用性上，所必需具有的基核解析要素。

爲研究這一解析要素，需先說明這一基核特性函數，並指出一些定義、符號標記、公式或方程式。此處依循 Daubechies 的用法及推演，將這一基核特性函數記爲 $m_0(\xi)$，而其相關數學內涵如下：

一個多階解析度分析（multiresolution analysis, MRA）其組成是爲一如下具包含性之封閉序列之子空間 V_j 集

$$\cdots V_2 \subset V_1 \subset V_0 \subset V_{-1} \subset V_{-2} \subset \cdots, \tag{4.1}$$

其中

$$\overline{\bigcup_{j\in Z} V_j} = L^2(\mathbb{B}), \tag{4.2}$$

$$\bigcap_{j\in Z} V_j = \{0\}. \tag{4.3}$$

此外，子空間存在有如下之關係：

$$f \in V_j \Longleftrightarrow f(2^j\cdot) \in V_0. \tag{4.4}$$

而子空間之整數移位效應所存在不變性是爲：

$$f \in V_0 \Longrightarrow f(\cdot - n) \in V_0 \text{ for all } n \in \mathbb{Z}. \tag{4.5}$$

至此所引生之相關的主論述是爲：存在有 $\phi \in V_0$，並使得

$$\{\phi_{0,n}; n \in \mathbb{Z}\} \text{是爲一在子空間 } V_0 \text{ 裡的正交函基或萊斯函基} \tag{4.6}$$

式中對所有 $j, n \in \mathbb{Z}$ 存在有 $\phi_{j,n}(x) = \sqrt{2^{-j}}\phi(2^{-j}x - n)$. 此處的 ϕ 習稱爲父仔波函數亦或稱爲 MRA 之 2-比例縮放量尺函數（2-scale scaling function ）。再者針對 $\{\phi_{j,n}; j, n \in \mathbb{Z}\}$ 存在有對應仔波函基爲 $\{\psi_{j,k}; j, k \in \mathbb{Z}\}$, $\psi_{j,k}(x) = \sqrt{2^{-j}}\psi(2^{-j}x - k)$，並使得

$$P_{j-1}f = P_j f + \sum_{k\in\mathbb{Z}} \langle f, \psi_{j,k}\rangle \psi_{j,k}, \tag{4.7}$$

式中 P_j 代表函數 f 於 V_j 子空間之投影，而因 $\phi \in V_0 \subset V_{-1}$，且 $\phi_{-1,n}$ 是爲 V_{-1} 裡之函基函數，此時得以將 ϕ 表爲

$$\phi = \sum_n h_n \phi_{-1,n}, \tag{4.8}$$

式中

$$h_n = \langle \phi, \phi_{-1,n} \rangle. \tag{4.9}$$

是故

$$\phi(x) = \sqrt{2} \sum_n h_n \phi(2x - n). \tag{4.10}$$

上式若以頻率領域表示，則如下：

$$\widehat{\phi}(\xi) = \frac{1}{\sqrt{2}} \sum_n h_n e^{-in\xi/2} \widehat{\phi}(\xi/2). \tag{4.11}$$

將上式表爲基核特性函數 $m_0(\xi)$，則其方程式是爲

$$\widehat{\phi}(\xi) = m_0(\xi/2) \widehat{\phi}(\xi/2), \tag{4.12}$$

式中

$$m_0(\xi) = \frac{1}{\sqrt{2}} \sum_n h_n e^{-in\xi}. \tag{4.13}$$

即爲此處所欲探討的基核特性函數。基本上 $m_0(\xi)$ 可以視爲建構母仔波與父仔波所用波濾係數之相關合成函數。

4.2 線性相位波濾

在電子工程學上，一般稱具對稱分佈之波濾爲線性相位波濾，若一波濾並非對稱，則其偏離對稱之程度，通常即以其波濾係數所組成之特性函數的相位性狀來衡量，而此一衡量係以其偏離某一線性函數之狀況來界定。今將此一特性函數式之定義說明如下：設若一波濾其濾波係數爲 $\{a_n\}$，而由這些係數所形成之方程式

$$a_\xi = \sum_n a_n e^{-in\xi/2} \tag{4.14}$$

是爲該波濾特性函數，若此一函數可以表成爲一個線性相位分佈的函數，則我們稱該波濾爲線性相位波濾。也就是說，此時 a_ξ 可以表爲

$$a_\xi = |a_\xi| e^{-il\xi/2}, \tag{4.15}$$

式中 $l \in \mathbb{Z}$，而此式亦表示 $\{a_n\}$ 之分佈是以 l 爲對稱中心之分佈，其 $a_n = a_{2l-n}$。就對稱性而言，通常此一線性相位可以推廣到非連續之狀況，只要是其線性坡度不變，而非連續點是發生於 $|a_\xi| = 0$。今將 $m_0(\xi)$ 與此處所引介之 a_ξ 交互參照，得以求算基核特性函數之相位分佈曲線，圖 4.1 迄 4.8 示所有全部仔波之基核特性函數之相位分佈。

4.3 相位分佈性狀暨水波物理關聯

- 就正交仔波而言，延伸其支撐長度，基核特性函數相位分佈所產生之變化性狀，可說具甚相似，且有不規則化之趨勢，這一點與前一章中熵值表現行爲是一致的。同時此亦說明，我們無法藉由拓展延伸這些正交仔波以獲得水波模擬上任何效益。至此，我們可以很肯定地說，任何正交仔波類屬或子類屬都不適合吾人水波研究之物理探討。

- 圖 4.4 示正交仔波其最不對稱子類屬之相位分佈曲線，而圖 4.5 則示其最接近對稱分佈之子類屬，圖中得見其最不對稱性子類屬所產生之相位偏離非線性情形。而其最接近對稱之子類屬，雖然我們仍然可以很明顯地看出其仔波形之不對稱性，但其特性函數相位分佈曲線在視覺上是非常接近線性分佈的。是故，由這兩者之表現，我們亦可很肯定地補充說，任何新構築，已知的、未知的有限支撐正交仔波，都不可能帶來顯著、甚或是些許的改善。因爲，它們的特性函數相位分佈曲線之性狀必然落於這兩種極端正交仔波子類屬之間。再者，我們的熵值研究結果亦爲這一切提供充分的驗証。

- 就交正交仔波而言，無論是原始仔波或匹配仔波，亦無論是針對自已的子類屬之間或不同子類屬之間之比較，其特性函數相位分佈情形都非常近似，這

一點亦十足說明，增加任何此類子群組之構建亦或是延伸其支撐長度，也是難以爲熵值表現帶來任何差異。再者，此類屬之相位分佈都具有相對規則性的線性相位分佈，而我們亦可將其線性表現性狀與正交仔波類屬中之最爲對稱性互爲參照，同時再參照這些類屬或子類屬的熵值現象，也如是乎，吾人可以再進一步明確的指出：正交與交正交類屬都不是水波物理研究的選擇。

- 在前述幾點裏我們已看到，曲線形狀上差異非常大的諸多仔波，是可以有相似的特性函數相位分佈形態或性狀，然而我們也可以看到，形狀非常近似的仔波，其相位表現特性或數值行爲可以甚爲不同。圖 4.1 與圖 4.2 分別示 Meyer 仔波與 B&L 仔波之特性函數相位分佈情形，而這兩者的仔波曲線分佈則如圖 2.13 與圖 2.14 所示，此處吾人可見其仔波波形之近似，但亦可見其基核特性函數相位數值表現之重大差異。前一仔波在頻率領域上有最短支撐長度，因而其波形爲無限可微且具無窮大之規則度，而後一仔波其父仔波建基於樞點順適函數，而其仔波波形具指數衰減及有限的整數規則度，因此我們可以查覺，規則度高低與特性函數相位之數值行爲之可預期性是不具相稱性的。再者，由前述幾點及此點所示，我們也可以很容易地了解，很多仔波數學特性，雖然在解析意境特立突出，然在水波物理實際應用上則難以找到關聯。

- 比較前一章中所有函基之熵值表現，再檢視此處所有之基核特性函數相位表現，我們可以得知，線性相位分佈之特性是完全不足用於相關於水波模擬之用途，亦即其波濾係數所形成之函基在物理解說上必然是非常薄弱。

- 在這所有的相位分佈曲線當中，其最爲特出的分佈，當爲樞點順適仔波的基核特性函數所顯示之水平分佈，如圖 4.3 所示，而此一仔波即爲前一章中鑑取所得之最佳仔波。此處我們所得到的重大信息是：這一仔波之基核特性函數不具相位變化之特性，即其相位值爲零，且其數值俱爲正數。這一點說明了，成就樞點順適仔波之最適化之數理因子，乃是基核特性函數其頻率領域分佈之全正性。此一特性暨其所帶來之結果必然是可對照於樞點順適仔波其時間領域上母仔波之全振性與父仔波之全正性。

- 綜合上述諸點，並綜合參照熵值與特性函數相位表現，我們得以充分得証下述論點：就仔波之觀點而言，水波是極其規則而變化簡單之波形，而它的模擬最適仔波函基是一個相對單純、形狀規則的仔波，其是爲半正交之樞點順適仔波，且這一仔波函基在水槽風生水波之模擬表現亦比富立葉函基是來得優越。

此處相位分佈相關 Asyst 程式爲

- `R_Pha.shl` ➲
- `LLet-Pha.asy` ➲ ❖

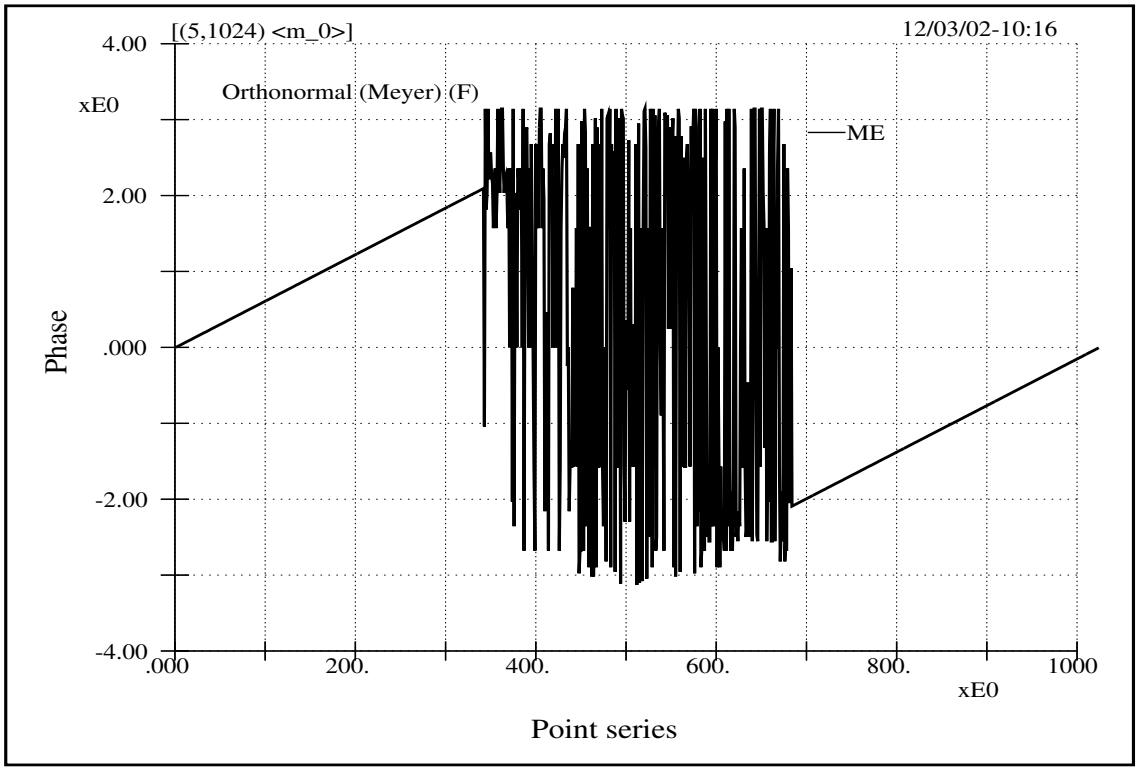


圖 4.1　Meyer 仔波基核特性函數 $m_0(\xi)$ 相位分佈

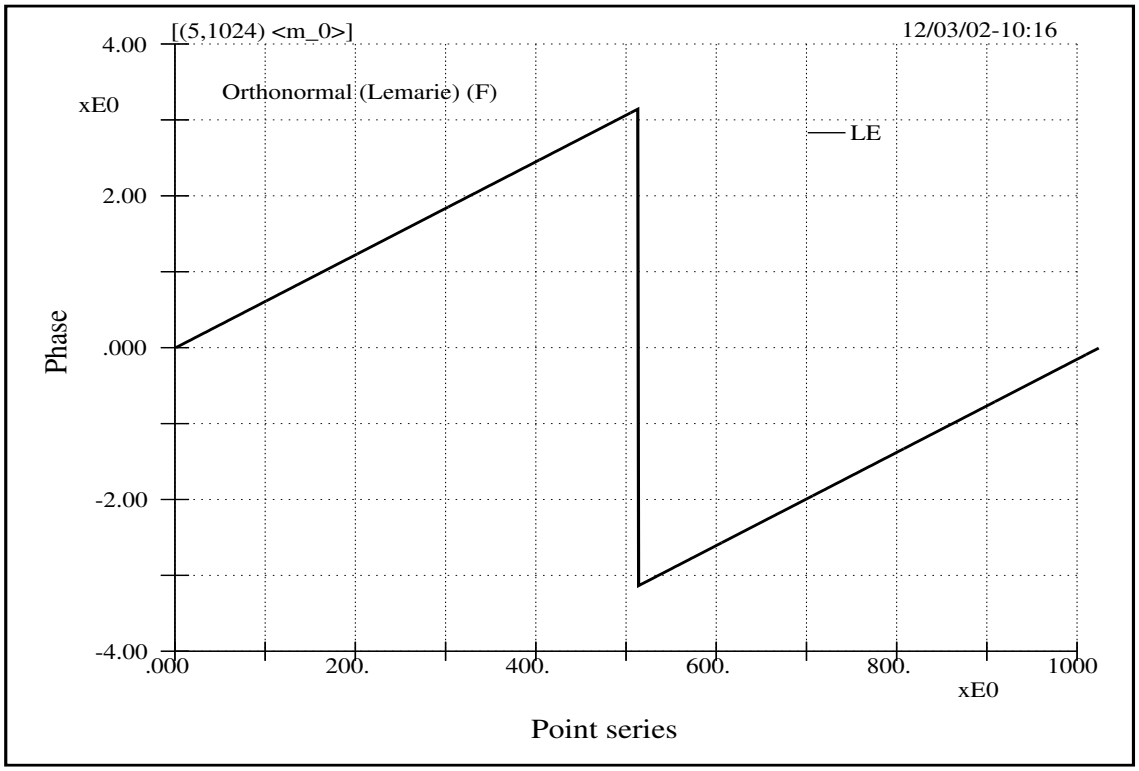


圖 4.2　Battle and Lemarié 仔波基核特性函數 $m_0(\xi)$ 相位分佈。與上一圖比較起來，可以得知：形狀非常近似的仔波，其相位表現特性或數值行爲可以甚爲不同。

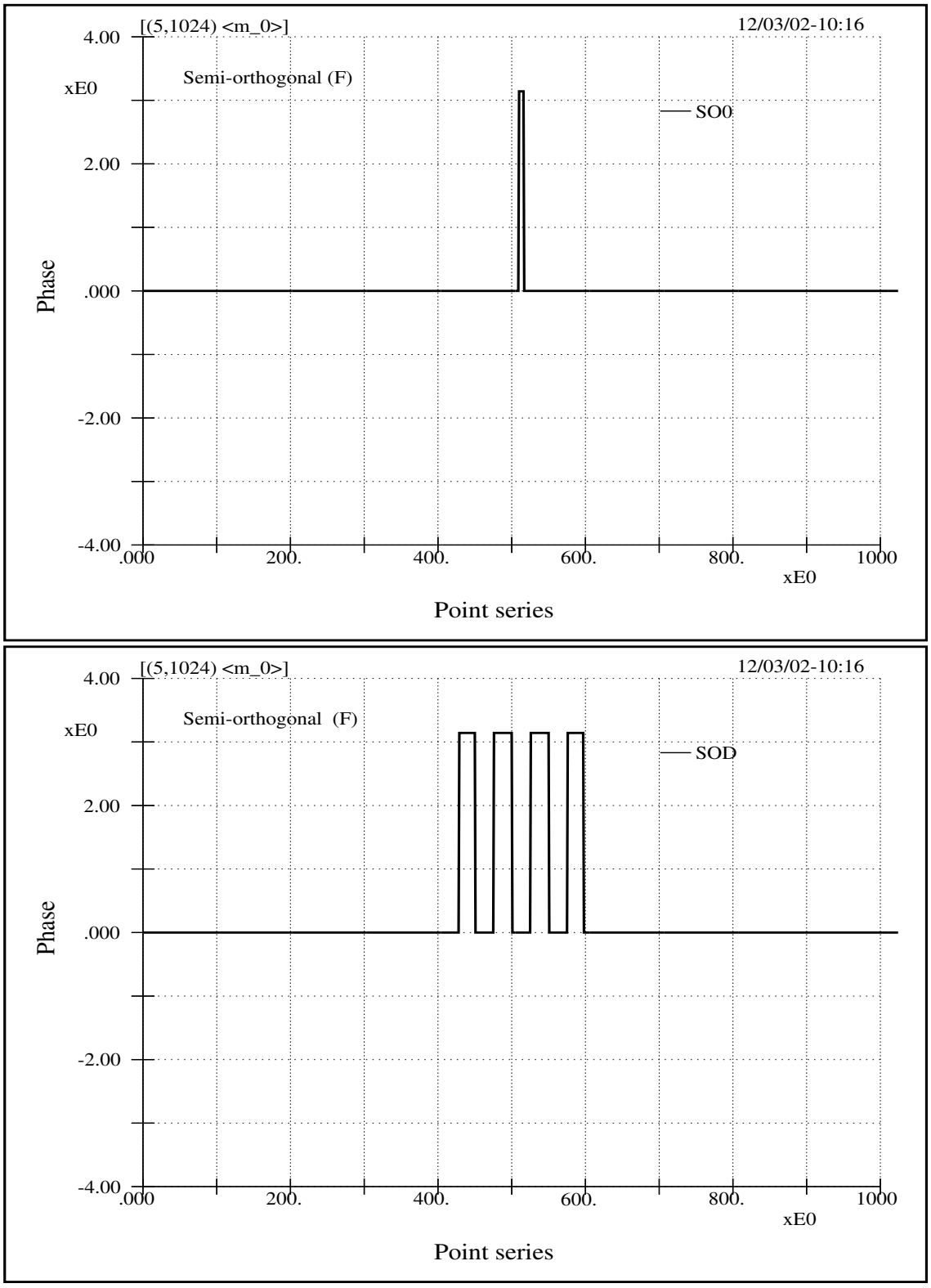


圖 4.3　半正交樞點順適仔波及其匹配仔波之基核特性函數 $m_0(\xi)$ 相位分佈

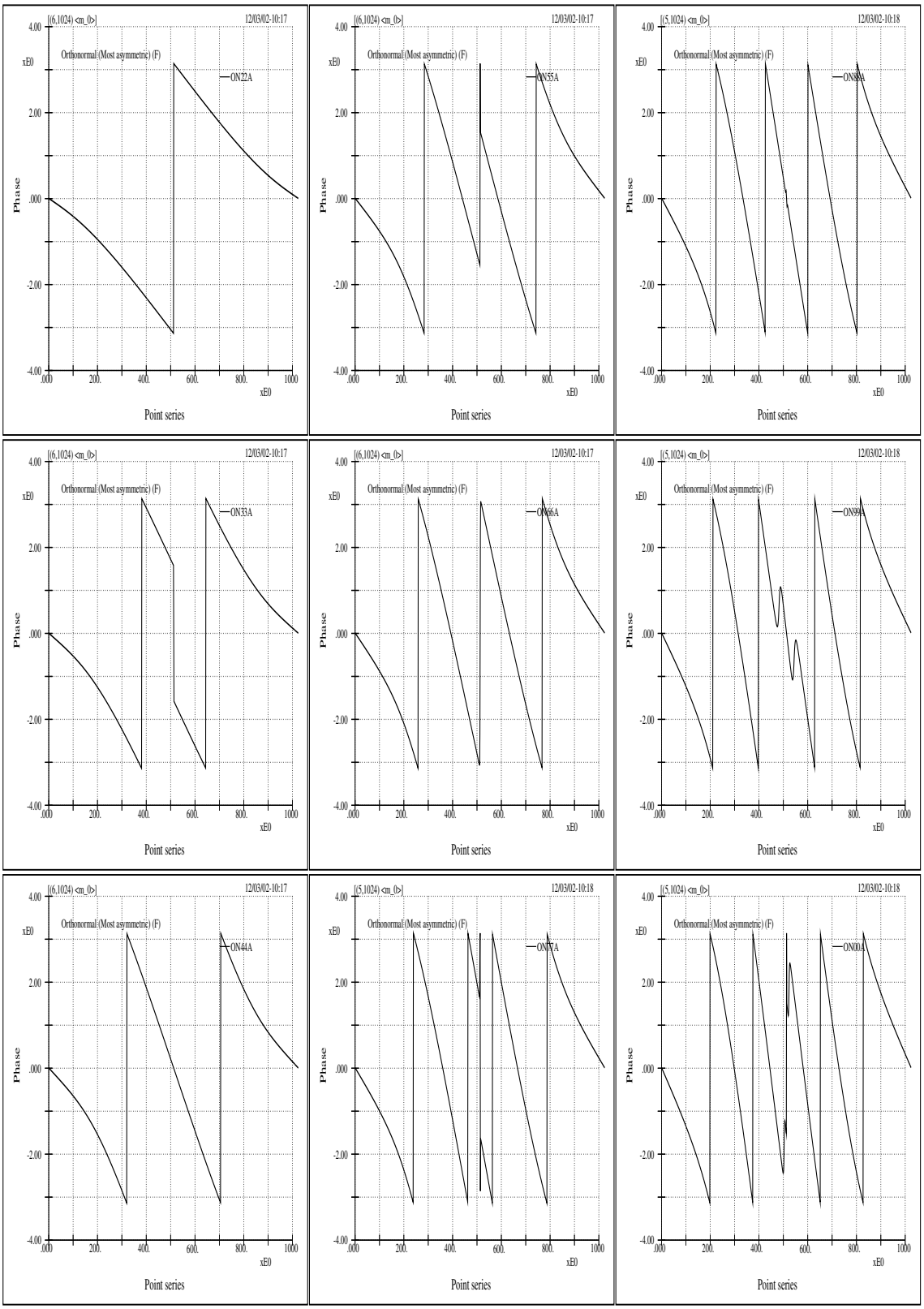


圖 4.4　Daubechies 最不對稱正交仔波之基核特性函數 $m_0(\xi)$ 相位分佈

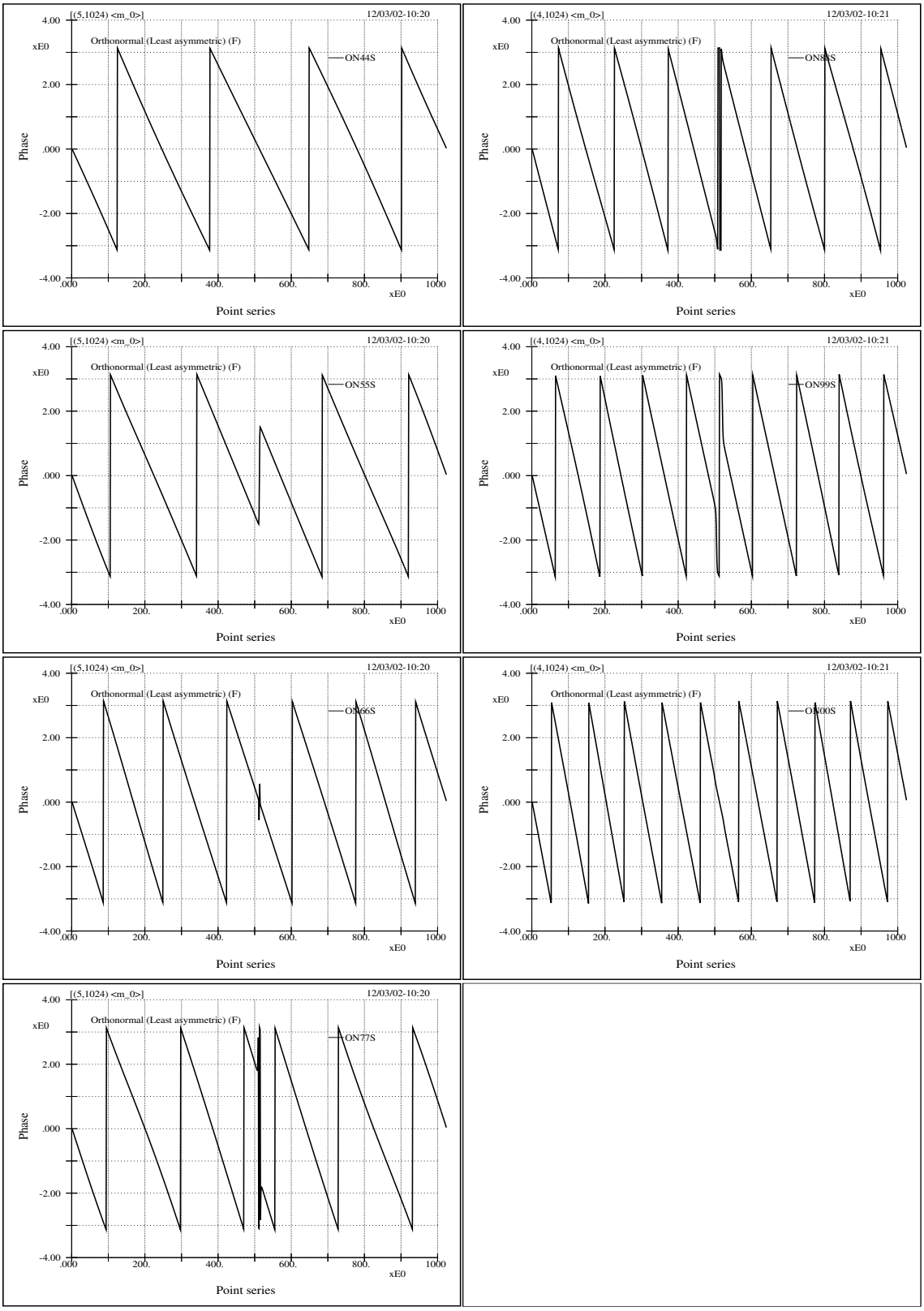


圖 4.5　Daubechies 最爲對稱（即最小非對稱性）正交仔波之基核特性函數 $m_0(\xi)$ 相位分佈

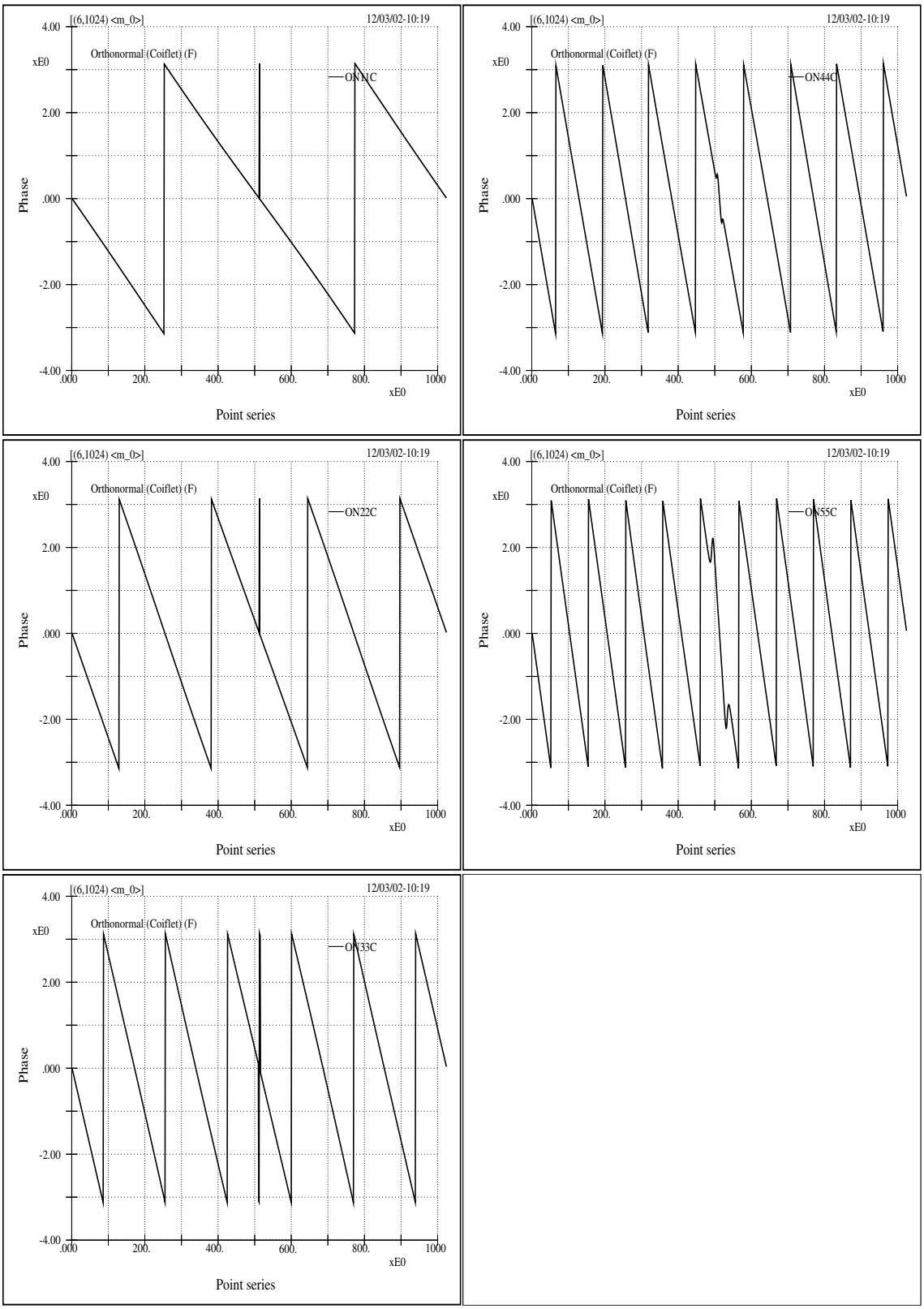


圖 4.6　Coiflet 仔波之基核特性函數 $m_0(\xi)$ 相位分佈

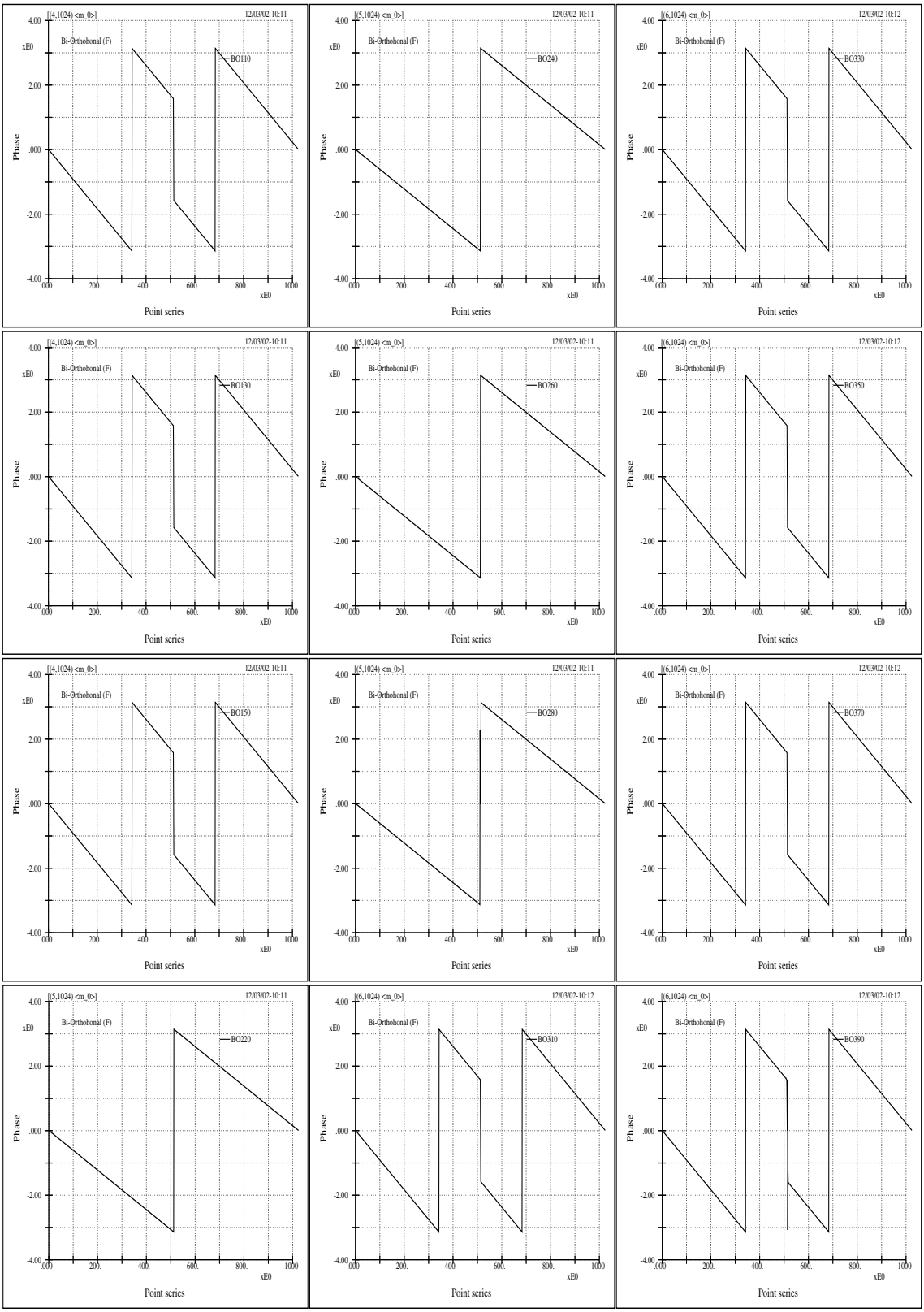


圖 4.7　交正交仔波之基核特性函數 $m_0(\xi)$ 相位分佈

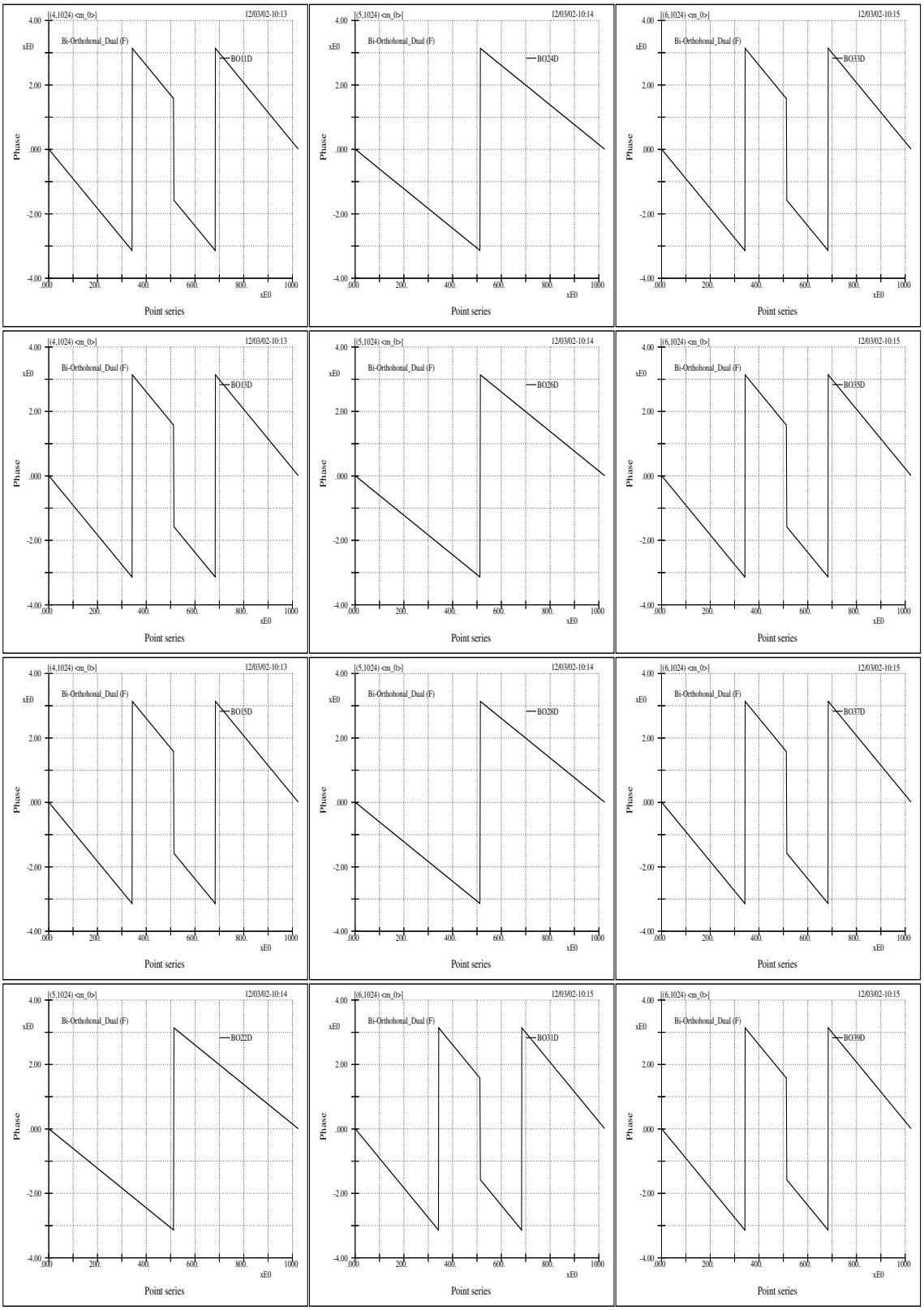


圖 4.8　交正交仔波其匹配仔波之基核特性函數 $m_0(\xi)$ 相位分佈

第5章

最適仔波與調適優化

5.1 仔波調變頻率與水波衰減物理

在前兩章中我們述說水波分析所當取用的最適仔波函基其最適化因由，如果以最簡單的方式來歸結，那可以說是：這一函基一方面對應於離散領域轉換係數的最小熵值，另一方面它對分析偏差、紛紜、扭曲的容忍性高，即反應性不極端。另其最適離散函基是爲樞點順適仔波（cardinal spline wavelet），此一最適離散最終所對應之最適連續仔波函基則爲莫利仔波（Morlet wavelet）。在這一章中我們探討這一最適仔波數學與水波物理的配合性如何，再針對其進行分析優化。

莫利仔波之母仔波（mother wavelet）是爲

$$\psi(t) = \pi^{-1/4}(e^{-i\omega_0 t} - e^{-\omega_0^2/2})e^{-t^2/2}, \tag{5.1}$$

式中 ω_0 爲一常數，而 $e^{-\omega_0^2/2}$ 這一項可說是針對蓋博函數（Gabor fuction）亦或調變的高斯函數所特別引入的修正項，其目的是在於讓經過這一修正的函數得以滿足仔波之入允條件（the admissibility condition.）。此母仔波的富立葉轉換爲

$$\widehat{\psi}(\omega) = \pi^{-1/4}[e^{-(\omega-\omega_0)^2/2} - e^{-\omega^2/2}e^{-\omega_0^2/2}]. \tag{5.2}$$

這一式也幾乎就是一個移位的高斯分佈函數（shifted Gaussian），此處的 ω_0 在物理上是針對振幅調變下的一個調變頻率（modulation frequency），而調變內容

爲高斯函數。如是之故，ω_0 亦隱含這波動振幅其變易之快慢。一個比較具體的指標就是拿母仔波的最高峰值與第二高峰值的對比值來記述。設若最高峰值位在 $t = t_0 = 0$ 而第二高峰值位在 $t = t_2$ 則此一比值爲

$$r = \left| \frac{\psi(t_2)}{\psi(0)} \right|. \tag{5.3}$$

另 ω_0 與 r 具一定的關係。而 t_2 的確值相關於一個超越方程式（transcendental equation），可以數值方法簡易求算。不過由於莫利仔波的第二項修正項之值與第一項主項之最大值基本上級距之差別一般約有四、五階，故把第二項忽略掉也可以得到相當準確的 r 值。此時

$$\omega_0 \approx \frac{2\pi}{t_2} \approx \pi \left(-\frac{2}{\ln r} \right)^{1/2}. \tag{5.4}$$

是故 ω_0 越大則 r 值亦越大，而 ω_0 爲常數，則 r 此值也維持不變。在莫利仔波母仔波中 ω_0 爲定數，也就是說，對任何尺度的仔波、亦或無論如何縮放的成分波，其 r 值皆爲固定。這裡自然而然的聯想就是：難道每個成分尺度的波形都具有一致的衰減特徵？

5.2 最適仔波調適優化

水波研究者都知道，一般若波浪其週期較長或波長較大，則其減衰現象也大底較和緩，而週期較短的水波或小波其生滅相對明顯而劇變嚴重。也如是乎，把 ω_0 取爲常數與我們的基本認知已不相符合。

以下就讓我們以水波黏滯性耗能所引致的波浪減衰來對比這一情形。在水面無覆蓋之乾淨狀況下，以深水波而言，則其因黏滯消能所引致之波能損耗可說幾乎都是來自於水柱體非旋性運動之剪應力所引生，而表面層部分的滯性應力所生的耗損則可忽略。此時的波能密度其時變率是爲（Lamb 1932 [8]; Phillips 1977 [22]）：

$$\dot{E} = -2\mu\sigma^2 {a_w}^2 k, \tag{5.5}$$

式中 μ、σ、a_w、k 分別爲水之動力滯度、波頻、波幅、波數（dynamic viscosity, wave frequency, wave amplitude, wave number），而因深水波之能量密度爲

$$E = (2k)^{-1}\rho\sigma^2 {a_w}^2, \tag{5.6}$$

式中 ρ 爲水之密度，故能量減衰係數（attenuation coefficient）爲

$$\gamma_\nu = -\frac{\dot{E}}{2E} = 2\nu k^2, \tag{5.7}$$

式中 ν 爲水之運動滯度（kinematic viscosity）因而能量密度之演化如下

$$E = C_1 e^{-2\gamma_\nu t}, \tag{5.8}$$

式中 C_1 爲一常數。此時水波振幅之降減則如

$$a_w = \sqrt{\frac{C_1 2k}{\rho\sigma^2}} e^{-\gamma_\nu t} = C_2 e^{-2\nu k^2 t}, \tag{5.9}$$

式中設若波頻 σ 並無變化，則 C_2 亦爲常數。

拿上面這一波浪減衰物理模式來跟莫利仔波其所設定之波幅降減比較，我們可以見得其同異之處。

由物理模式的降減式，我們知道，水波其波數越大則衰減越形劇烈，亦或說高頻波其生命之幻化相當無常，而長波其波幅變化相對緩慢。而這一點已否定了把 ω_0 視爲定值的正當性。今將莫利仔波的移位及縮放式

$$\psi_a\left(\frac{t-b}{a}\right) = \pi^{-1/4}\left[e^{-i\frac{\omega_0}{a}(t-b)} - e^{-{\omega_0}^2/2}\right] e^{-\frac{(t-b)^2}{2a^2}}. \tag{5.10}$$

與物理模式之振幅降減式參照比較，我們得見其相似之處爲：兩者的衰減係數都相依於尺度量之平方的倒數，對仔波而言是相依於 $(1/a)^2$，對物理模式而言則相依於 k^2)；而其相異之處則爲：兩者對時間的相依性明顯不同，在莫利仔波中是 t^2 冪次相關，而在物理模式中則只是 t 線性相關。由此我們可以預期，一個固定形

狀的母仔波，亦或是不變的 ω_0，其縮放之不同尺度是無法對水波組合成分提供全面性的物理切適性。簡而言之，一個固定的莫利母仔波它不是高估了低頻端成分波的降減，就是低估了高頻端成分波的衰敗，亦或是兩者兼而有之。若由式 5.7 暨一般常取用的莫利仔波 $r = 0.5$ 值來判斷，則可認知這一偏離對於長生命期的水波是較明顯的。而這一點也可以說明在穩態現象（steady state）下，仔波技法的使用多多少少必然失去了它具有的基因優勢。如上所述的物理與數學糾結，正顯示我們何以將各類各式的技法稱之爲「modality」。仔波分析是一項工具，但它也可能形成一把殺雞的牛刀，愼之，勉之。

以上的說明提供本研究分析優化之核心概念。藉著調整莫利母仔波其振幅之降減力道來增益不同尺度成分水波演化物理。亦即藉著調整前述 r 值，在不同尺度下使用不同的 ω_0 值。而不同的 ω_0 值，其時頻窗之分佈自是不同。換句話說，我們現在所用的莫利母仔波不是固定的，其初始時頻窗是變動的。

根據上面論述，此處對時頻窗調適原則相當直覺。對具有長時間支撐的成分波取較大的 ω_0，而其頻寬相對爲窄；另一方面，對短時間支撐的成分波則取較小的 ω_0，另其頻寬即相對較寬。亦即此時

$$\omega_0 = \omega_0(a). \tag{5.11}$$

此時經縮放移位的仔波是爲

$$\psi_a\left(\frac{t-b}{a}\right) = \pi^{-1/4}\left[e^{-i\frac{\omega_0(a)}{a}(t-b)} - e^{-\omega_0(a)^2/2}\right]e^{-\frac{(t-b)^2}{2a^2}}. \tag{5.12}$$

而在此一調適下，不同尺度仔波所對應之載頻幾乎即爲

$$\omega = \frac{\omega_0(a)}{a}. \tag{5.13}$$

此處我們亦可了解只使用無因次 a 來表示物理現象之不足及缺點，其不僅模糊抽象，更因爲同樣一個 a 值可以對應任意的 ω_0，即對應不同的載頻，亦或不同的母仔波可以有相同 a 值但實際上代表不同尺度。而相對地，如果使用載頻來記述，

那就可以避免這一基準不同所帶來的困擾。

數位訊號必然是離散的，而通過這些所有離散點的函數基本上是無限多，這些函數可以是有限頻寬，也可以是無限頻寬，不過數值分析往往只相關於有限頻寬，亦或往往只在乎某些尺度範圍，這一點多多少少反應出連續仔波轉換其贅餘性的相關因子，另一方面也反應出我們對其進行調適之可行性。接著我們說明此處對波浪衰減表徵參數之直覺性調適。

一般莫利仔波所取的 ω_0 值爲 5，此一 ω_0，對應的波浪衰減參數 r 是比 $\frac{1}{2}$ 還來的小。在 $r = \frac{1}{2}$ 下， $\omega_0 \cong \pi(-\frac{2}{\ln \frac{1}{2}})^{\frac{1}{2}} \cong 5.3$，因此我們大致很容易認定，對大多數人所研究的海洋波浪而言，這一數值有相當多的偏差。不過本文中所用的實際水波是爲試驗室小水槽裡的風生波，另其頻率基本上約以 2.5 Hz左右爲主要分佈帶，這些風生小水波的幻化相對甚快，因而其 ω_0 對 $\omega_0 = 5.3$ 之偏離嚴重性應比前述海洋水波的狀況來得輕。

另一方面，參考前面對水波滯性衰減現象之描述，我們可以體會，相對於長波而言，針對這些小尺度風生波進行 ω_0 調適可以比較明顯展現一些效益，因爲此時 ω_0 的分佈可以在一個較大的範圍內取用。另其調適處理方向應該如下：對其頻帶分佈偏向長波的部分，可以明顯加大 ω_0 的異動範圍，而對頻帶偏向高頻小尺度部分， ω_0 相對地只需小幅度變化異動。簡單的說，在大尺度的部分，其所取 ω_0 明顯增加，而小尺度部分， ω_0 則變化較小。基於這一物理上的理念，此處我們對 $\omega_0(a)$ 的取法尚是一個相當直覺的假設。這一假設如下：

$$\mathrm{Erfc}\left[\frac{4}{10}\left(\frac{\omega_0}{a}+2.5\right)-2\right]3+5=a\omega \tag{5.14}$$

式中 Erfc 爲互補誤差函數（complimentary error function），ω 爲實際載頻。圖 5.1 爲 ω_0 分佈圖，另圖中亦隱示其各常數之選定邏輯，主要考量爲：參考標準的互補誤差函數其分佈情形，將橫軸大致分佈範圍由 4 單位延伸至 10 單位，另因所探討訊號其頻帶分佈中心約爲 2.5 Hz，故將曲線中心左移 2 單位，而 $\omega_0(a)$ 分佈區間介於極限 5 與 11 之間。圖 5.2 示此一水槽風生波的時尺分佈圖。其上子圖相應於固定母仔波下的時頻窗參數 $\omega_0 = 5.3$，下子圖則爲調適化時頻窗者。如前頭所提

及，此時主要的調適在大尺度範疇，即低載頻部分。另時頻窗參數由小尺度以迄大尺度所涉實際分佈範圍則從 5.26（小尺度端）以迄 9.16（大尺度端）。這裡必須加以說明的是：雖然我們的調適對主頻帶之低載頻部分特別地將 ω_0 明顯加大，亦即其所取用的母仔波時頻窗分佈面積是大大增加，但它所帶來的模糊效應卻更低。這一現象必然可以推論、亦或歸功於：這樣的調適比較符合物理，所以即使基準時頻窗變的很大其模糊效應卻明顯較低；因爲母仔波的時頻窗若越大，則表示其局部性越低，亦或解析度越低，而模糊現象顯著。

另外的一些特徵描述爲：（1）調適化時頻窗下其主頻帶分佈仍約爲 2.3 Hz。（2）各不同尺度成分均不斷演化，代表能量强度的黑白色隨時間交錯出現。而其高頻帶的演化，在調適狀態下，較未調適者來的緩和。（3）在調適狀態下，其明顯能量區帶處的演化，因模糊效應降減，而有較清晰的變動更易性，即明暗對比較强烈，或說其生滅亦或週而復始性較突出。這一方面所代表的是，此時之轉換係數分佈大小差異變大，也就是說，轉換效率提高，而其熵值變小，蓋因物理符合性大爲增進。（4）風生波的群聚現象比較明顯表現，此與側頻不穩現象或相符合。另尺度間的歧支行爲（bifurcation among scales）亦較清礎，此一由較大尺度而來的能量渲洩行爲（energy cascade）其頻率區間約爲 2.8 至 4.5 Hz。

圖 5.3 則示一純粹數值模擬訊號之比較圖。此訊號爲二次方漸高頻訊號（parabolic chirp），其所含蓋頻率區間爲零以迄尼克斯取樣頻率（Nyquist sampling rate），而時頻分析圖其所覆蓋頻率亦爲全範圍。這裡所用的 $\omega_0(a)$ 由小尺度端的7以迄大尺度端的 10，另取其爲線性改變。而對比圖則用固定的 $\omega_0 = 5.3$。由圖可見，除了最低的兩個載頻帶以外，所有其它載頻都有比較局部化的時頻分佈。事實上，最低載頻區帶的模糊性主要來自數值分析上嚴重的邊緣效應，若欲將其模糊區帶範圍減縮，則所用母仔波時頻窗的時支撐宜降減，也就是把此處的 $\omega_0(a)$ 另調適變的比 5.3 還小，但此時邊緣效應仍是明顯存在的。另圖 5.4 中的上子圖示其相位分佈圖，而右子圖係爲全頻域之二次方漸高頻訊號。

此處相關連續仔波轉換 Asyst 程式爲

- `S_WVT.shl`

- LLet-WVT.asy ➲

相關 Mathematica 程式爲

- TFR-WV_Shell ➲
- TFR-WV_Stand-alone ➲ ❖

```
obeg=11.;  oend=5.;
fcenter=2.5;  fdilation=10/4;   fshift=2. ;

perfc=Plot[ Erfc[(1/fdilation)* (freq +fcenter)-fshift]*
                          (obeg-oend)/2+ oend, {freq, -2.5, 8.5} ]
```

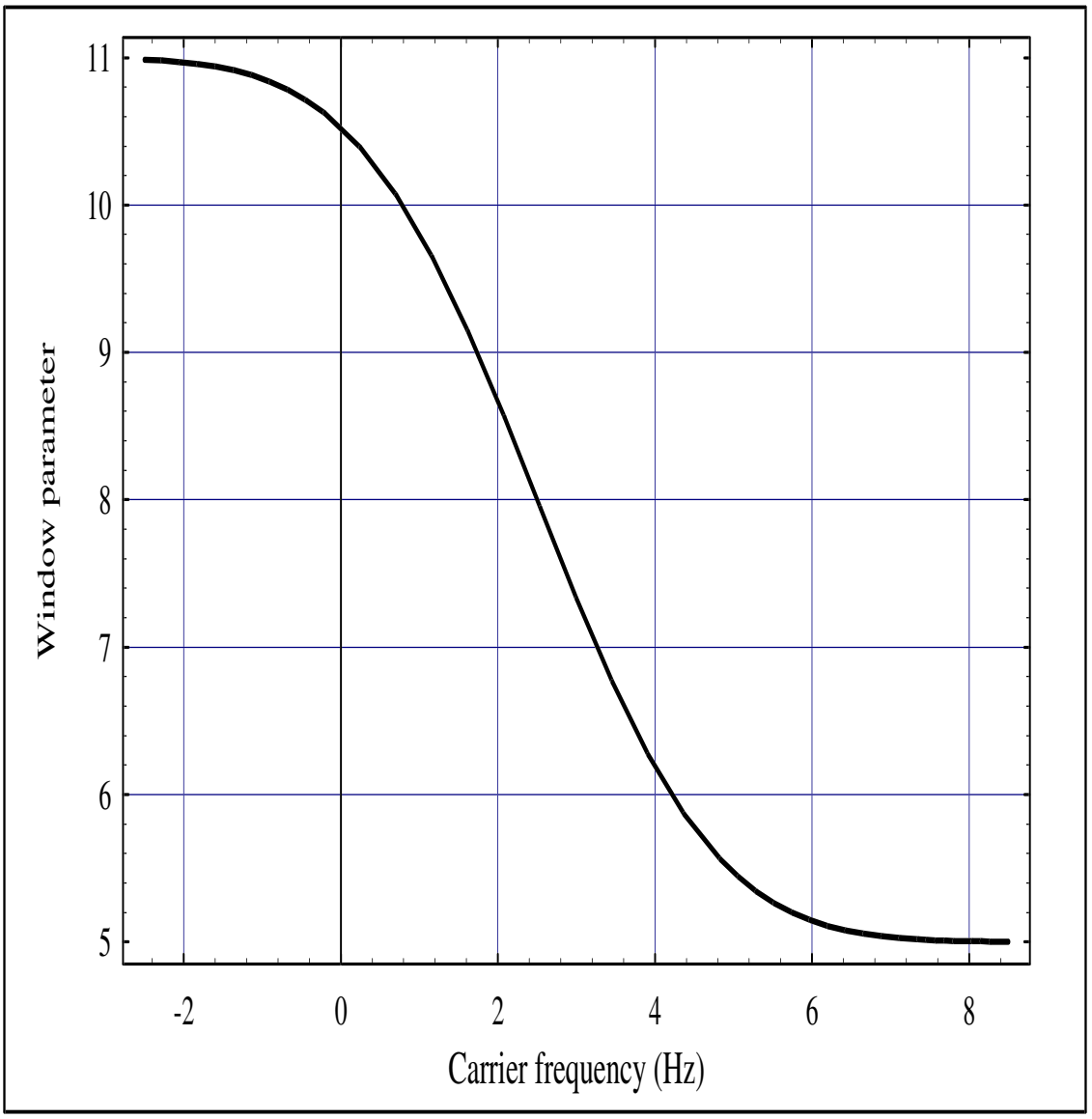


圖 5.1　代表波浪減衰之參數 $\omega_0(a)$ 與載頻之關係曲線。此處的取法尚是一個相當直覺的假設。另圖中亦隱示其各常數之選定邏輯，其互補誤差函數調整的主要考量爲：載頻大致分佈範圍、尖峰能量頻率、訊號其頻帶分佈中心位置、減衰參數分佈區間。

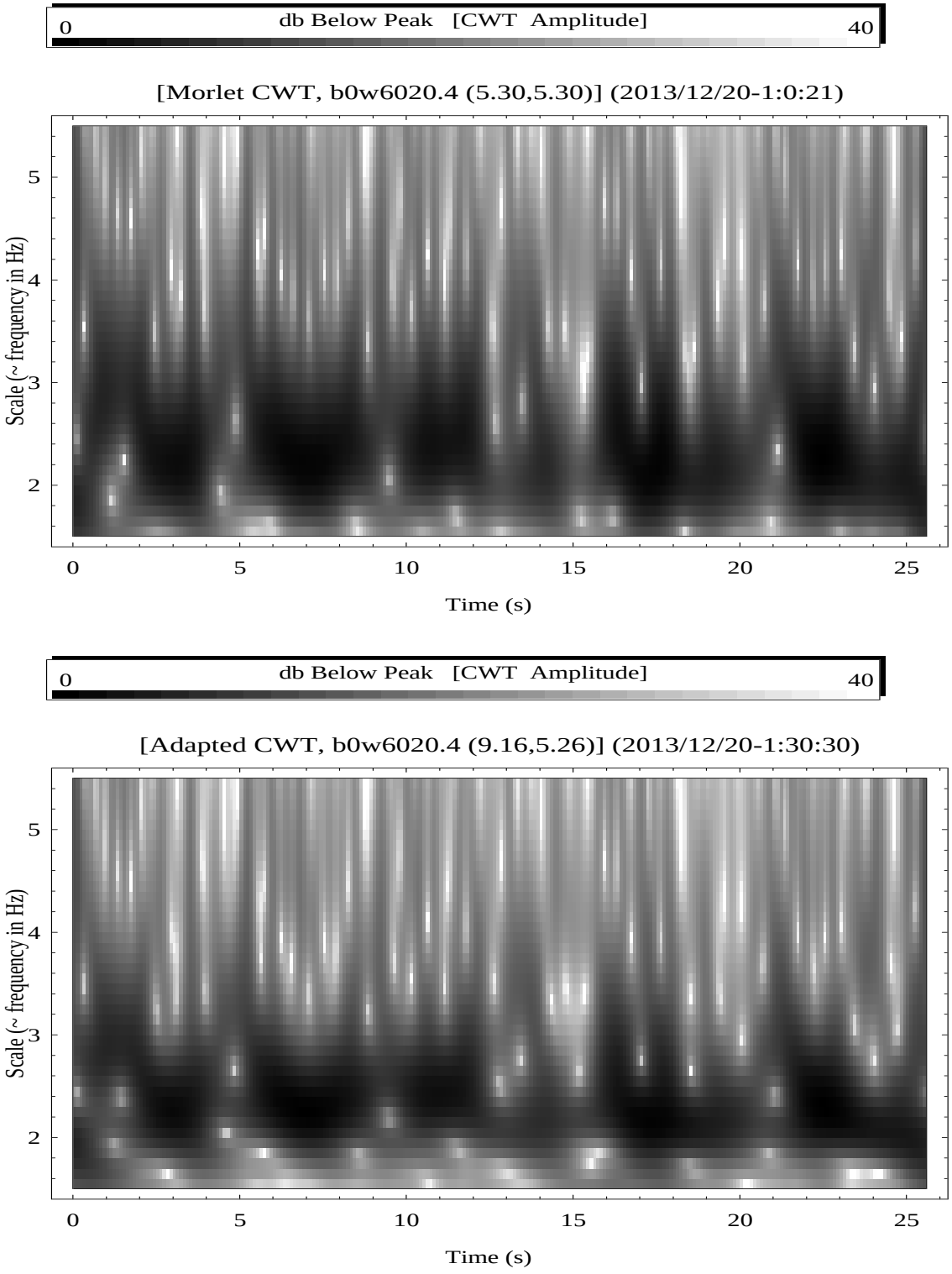


圖 5.2　時頻分佈比較圖。其所用訊號是爲試驗室小水槽裡的風生波，這些風生小水波的幻化，相對於一般海洋波浪者，相對甚快。相對於長波而言，針對這些小尺度風生波進行 ω_0 調適可以比較明顯展現一些效益。此時 ω_0 的分佈可以在一個較大的範圍內取用：對其頻帶分佈偏向低頻的部分，可以明顯加大異動範圍，而對頻帶偏向高頻小尺度部分，只需小幅度變化異動。在調適狀態下（下子圖），其明顯能量區帶處的演化，有較清晰的生滅變動性，因模糊效應降減，即明暗對比較突出。這一方面所代表的是，此調適下，轉換效率提高，而熵值變小，蓋因物理符合性大爲增進。

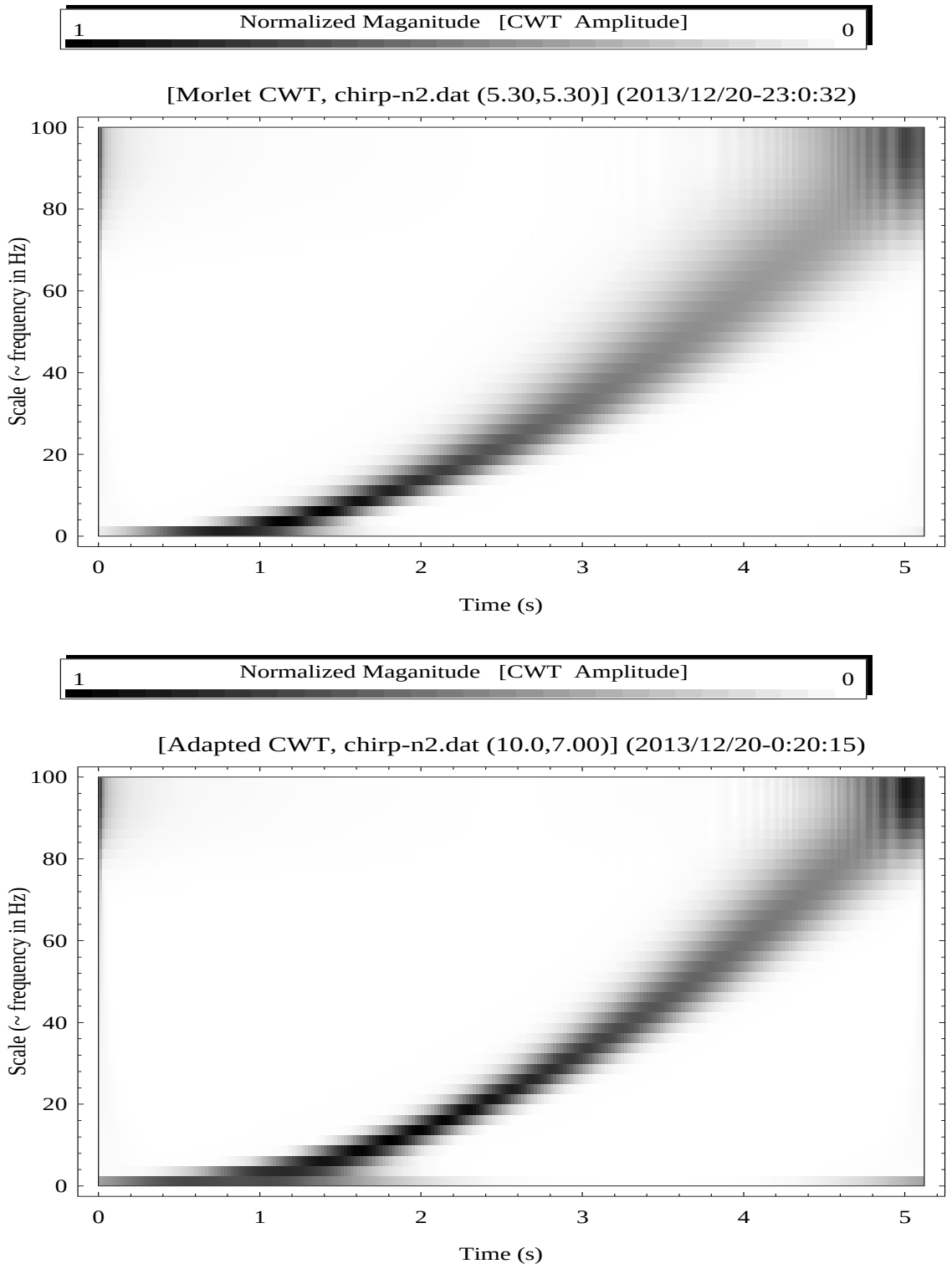


圖 5.3　此圖示一純粹數值模擬訊號之比較圖。此訊號爲二次方漸高頻訊號（parabolic chirp），其所含蓋頻率區間爲零以迄尼克斯取樣頻率（Nyquist sampling rate），而時頻分析圖其所覆蓋頻率亦爲全範圍。 $\omega_0(a)$ 由小尺度端的 7 以迄大尺度端的 10，另取其爲線性改變。而對比之上子圖則用固定的 $\omega_0 = 5.3$。由圖可見，除了最低的兩個載頻帶以外，所有其它載頻都有比較局部化的時頻分佈。

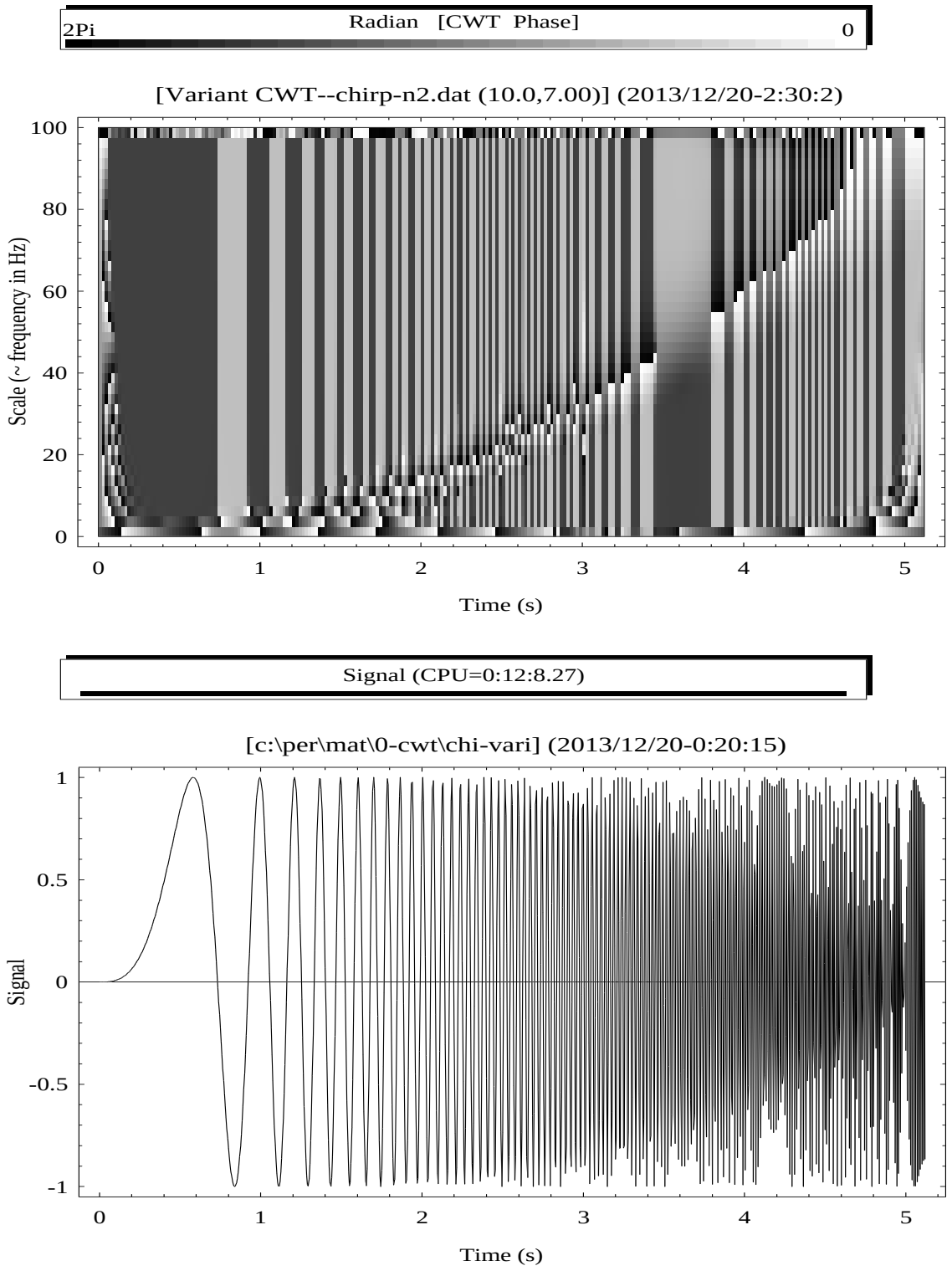


圖 5.4　此圖中的上子圖乃前圖二次方漸高頻訊號其相位分佈圖，其係以吾人所提之類仔波（wavelet variant）爲之 [13]。而下子圖係爲具有全頻域之二次方漸高頻訊號。

第 6 章

最適仔波之共關協振與富立葉共關協振

6.1 最適仔波函基檢核及確論

在熵值結果裡，我們已知最適函基之各種熵值表現均遠較其它函基來得優越，就風生水波訊號而言，仔波最適函基亦較富立葉函基傑出，而值得再强調的是不論二階或一階 norm 熵值，最適函基均較富立葉函基來得小，這裡該說明的是：二階熵值强調能量，其乃相關於大尺度行爲，而一階熵值則相對地强調變位，其乃相關於小尺度現象之凸顯。這一特質無異指出，就吾人所研究之訊號類型而言，此處所得之最適仔波必然較富立葉函基在物理解說方面會有更全盤性或廣泛性的優越表現。接下來所需要的便是証據之提供了。此處對仔波共關協振與富立葉共關協振之探討，一方面乃爲前述樞點順適仔波提供最適化之檢核及確論，另一方面則是展現此一最適仔波的一個具體應用面 [4, 14, 15, 10]。

6.2 富立葉波譜共關協振關係式

設 $g(t)$ 與 $h(t)$ 爲兩個以 t 爲變數之函數，則其交相關函數（cross correlation function）爲如下之內乘積（inner product），

$$c(t) = \langle g(t+\tau), h(\tau) \rangle, \tag{6.1}$$

式中 τ 爲虛擬變數，而其相關係數函數 $r_s(t)$，則爲

$$r_s(t) = \frac{c(t)}{\|g(t)\|\|h(t)\|}, \tag{6.2}$$

上式之富立葉領域對應式爲

$$\frac{\widehat{c(t)}}{\|g(t)\|\|h(t)\|} = \frac{G(\omega)\overline{H(\omega)}}{\|G(\omega)\|\|\overline{H(\omega)}\|}, \tag{6.3}$$

式中 ω 爲對應於 t 之富立葉領域變數，而函數之上頭直橫線表共軛值。根據這一關係式，共關協振函數遂可依下式給定，

$$R_s^2(\omega) = \frac{|\mathbf{E}[G(\omega)\overline{H(\omega)}]|^2}{\left(\mathbf{E}[|G(\omega)|^2]\mathbf{E}[|H(\omega)|^2]\right)^{1/2}}, \tag{6.4}$$

式中 **E** 代表期望值。就此一波譜共關協振函數而言，其與正確解析上的差異主要有二，其一乃期望值之導入，另一則爲常規標準化（normalization）之導入。

6.3 仔波共關協振關係式

至於仔波共關協振關係式則可如下推衍給定：上述兩函數其仔波同等位單元解析（the wavelet resolution of identity）爲

$$\langle g, h\rangle = \frac{1}{c_\psi}\int_0^\infty \frac{1}{a^2}\int_{-\infty}^\infty \langle g, \psi_{a,b}\rangle\overline{\langle h, \psi_{a,b}\rangle} db da, \tag{6.5}$$

式中 ψ 爲仔波函數， c_ψ 爲常數。就某一尺度 a 而言，其分量等位解析爲

$$\langle g_a, h_a\rangle = \frac{1}{c_\psi}\frac{1}{a^2}\int_{-\infty}^\infty \langle g, \psi_{a,b}\rangle\overline{\langle h, \psi_{a,b}\rangle} db. \tag{6.6}$$

檢視這一式子，同樣地將期望值與常規標準化的義涵應用於上，則我們得到仔波共關協振關係式如下：

$$R_w^2(a) = \frac{|\mathbf{E}_b[\langle g, \psi_{a,b}\rangle\overline{\langle h, \psi_{a,b}\rangle}]|^2}{\left(\mathbf{E}_b[|\langle g, \psi_{a,b}\rangle|^2]\mathbf{E}_b[|\langle h, \psi_{a,b}\rangle|^2]\right)^{1/2}}, \tag{6.7}$$

式中 b 代表仔波轉換中的移位參數（translation parameter），而 $\mathbf{E}_b$ 表針對此移位參數取平均。

6.4 仔波與波譜共關協振比較

上面兩個共關協振關係函數我們可給予如下之定性比較：波譜共關協振其期望值之導入是較不自然的人爲加工。反觀仔波者，其期望值實際上是很自然地對應於仔波移位變數之求積，可說幾乎不含人爲介入，也就是說應用式與正確解析式少了隔閡。而實際上我們還可以眞正的資料處理手法加以具體闡述如下：

對波譜共關協振關係式而言，若資料處理時不再經過進一步的人爲操控，則該式實際上是一無用處，蓋因此式對任何兩個訊號或函數而言，其任何頻率上的共關協振係數完全都是相等的單位值（即 unity）。實際的求算是必須把兩個函數都切割分段，各安排成多一個因次之矩陣，因爲如果沒有這樣一個多出來的因次，則期望值不發揮作用，即每一個變數都只對應有一個樣本。至於切割法則正如離散轉換下富立葉波譜求算的切割方式。反觀仔波共關協振則不需任何切割，基本上每一個 b 值都提供了一個統計樣本值，如是，我們很容易了解到，這樣一個樣本空間的樣本數通常會較波譜共關協振樣本數大上二個— 甚至是三個— 級距（order）。

前面的說明似乎已明確提示著，相關於波譜分析之特性行爲也將具體而微地出現在波譜共關協振的表現行爲上。這些主要相關於波譜分析或正交類屬函基其自由度（degrees of freedom）、變異數（variances）、移位非不變特性（shift non-invarince property）、相位糙音（phase noises）、模糊效應（ambiguity effects）、與數值處理過程額外引入的一些效應等。

此外，值得一提的是，此處我們所給予的仔波共關協振關係式與 Liu（1994, [17]）所用的共關協振是截然不同的。 Liu 所用的，暨其數值分析例，缺少此處共關協振關係式之要義，可說是不具期望值之概念。也因此，參照我們先前相關於仔波等之研究經驗及此處之結果，可以說明其文章表示之義涵具有相當大的非穩態現象，或則說是甚高的不確定性，只宜作局部或片段的現象陳述，或單一現象所屬之偶發性行爲，而不宜當作整體代表行爲或一般趨勢之描述。

圖 6.1 示三種資料長度下，風生波其波高與水流間之仔波共關協振分佈曲線。圖 6.2、 6.3 則示同樣三種資料長度下，同樣波高與水流間之富立葉波譜共關協振分佈曲線。各圖中之上、中、下子圖其資料長度分別爲 1024、2048、4096 點，水速之量測點分別爲靜水面下 2、3、4、5、9 cm，波高是相應於 6 m/sec 之風浪，水流與波高計同步量測斷面基本上在同一位置（相距 0.5 cm）。圖 6.2 與 6.3 是同屬波譜者，但係選用兩種不同 FFT 參數，主要在自由度大小之差別。

由這些圖或各子圖之比較，馬上得以看到一個最突出的結果，那就是：即使只要用 1024 點，仔波共關協振的諸分佈曲線可說已顯現非常良好的趨勢，且它們都已很接近數據資料長度較長下的分佈情形。事實上，在此一試驗條件下， 1024 點（相當於 25.6 sec）對一些資料分析觀點而言，其統計可說還是相當非穩態（non-stationary），然而就仔波共關協振的觀點言，所有曲線則已顯示出其甚小之異變行爲。至於波譜者其行爲表現可說相差非常大，此外有一點可以斷言的是，在高頻部分，波譜共關協振常見有尖凸之峰形，這些可以說沒有實質意義，它們是引入之糙音，其中包含資料處理時區段分割與邊緣效應所肇生成分。

圖 6.4 另示一甚長資料長度下之波譜共關協振，此時所用點數爲 9472 點。綜合前述各圖，尙可具體推論如下：

- 就波譜共關協振而言，資料長度之增加對其共關協振行爲之增益改善是非常緩慢的，且其效用越來越不明顯，特別是在能量相對較低之尺度區或高頻帶。

- 就仔波共關協振而言，使用甚少之資料量，其共關協振分佈已具穩態特性，亦即長度增加並不改變其分佈情形，這裡具有三層意義。其一表示：仔波共

關協振分析不需要很大的數据量。其二表示：就此處試驗水波訊號而言，所取的 1024 點資料長度已可非常適當對水波各成分波加以模擬，以物理觀點而言，是說成分波浪生命期小於1024 點，用解析術語言，是說這一長度可以含蓋函基中各建構函數之延展拓撐長度（support lengthes）。其三是說：隨著使用資料長度之增加，此處連續仔波轉換係數其贅餘性所提供的有用訊息亦快速微量化，因而過多的數据其助益不大。

- 比較使用 9472 點之波譜共關協振分佈與仔波者，我們可以查覺兩者間其曲線形態具有某些程度的相似性，這一點得以讓我們作如此的推論：對水波而言，此處相關於小水槽風生水波而論，由於它們相對的屬於小波，拿來與大尺度之海洋波浪對比，它們的週期短，同樣地，生命期也短；所以說，即使是針對這類屬於最不規則的水波，吾人也必需使用最規則— 亦或說是波形極其簡單— 之仔波加以模擬。這一情形無異告知吾人：以水波來對比於各類屬仔波的波形，那水波可說是極爲規則緩變的，這在仔波解析上的數學術語就是說，此一最適性乃相關於仔波函數之全振性、全正性、規則度（regularity）、或可微分性，而另一方面，則是說，幾乎所有「奇特」仔波，都很難在水波研究中一展所長，特別是當我們是著重於物理層面之探討時。

上述主要就曲線之分佈或其表現行爲作表徵說明，而造成這些不同表現的數理因子尙可另加解說的有：

- 使用正交或非正交函基其所造成之差異性。波譜函基是爲正交者，正交函基轉換係數變異性一般均相當嚴重，因而造成數值收斂性甚低。而此處相關於最適函基之仔波，則是一個相當鬆散的非正交、亦且屬於連續轉換形式的仔波。

- 使用離散轉換時，計算所得的許多或大部分的轉換係數都是浪費的，算是一種作虛功的求算，因爲它們所處的尺度區間或所處頻帶區與我們所欲探討尺度區間毫無關聯，因而可說這些係數幾乎都不相關於我們所要的物理義涵，換句話說，很多數據處理是浪費在那些對我們討論內容沒有絲毫助益的求

算。比如，就波譜共關協振而言，整個求算進行的頻率區間是從 2–點切斷頻率以迄尼克斯頻率之間（即 cutoff 與 Nyquist rate 相應頻率），而這一區間一般都遠遠超出有義物理頻率，舉例言，此處水槽風生波主頻帶不逾 1 至 4 Hz，此外尚可視風速調小頻帶區範圍。反觀此處仔波共關協振就沒有這一問題，其所有無關緊要的頻帶區都可以不必求算，只要針對研究有義區間作數值轉換即可，再者，其解析點位置與密度尚可任意給定。

- 對正交轉換或離散轉換而言，一方面由於其解析點位置是固定，另一方面則是解析點的數目亦有其限制，致使眞確尺度無法映投於正確解析點上，因而造成了折映投射現象，而再加上離散或正交轉換其移位非不變性所造成效應，遂形成相當擾人的變異性與不定性。而這裡也實質上突出了分析優化所需的兩個重要因子，即最適化仔波暨連續轉換所關聯的贅餘性。相關現象說明尚可參考圖 2.30、2.31、2.29。

此處仔波共關協振與波譜共關協振相關 Asyst 程式爲

- `S_Coh_WC.Shl`
- `S_Coh_SC.Shl`

另此處及各章節之 Asyst 相關圖表處理程式爲

- `P-WCoh-A.shl`
- `P-SCoh-A.shl`
- `FigA-Ini.asy`
- `FigAPlot.shl`
- `FigAPlot.asy`
- `FigABP.bpf`
- `C-CC-A.BPF` ❖

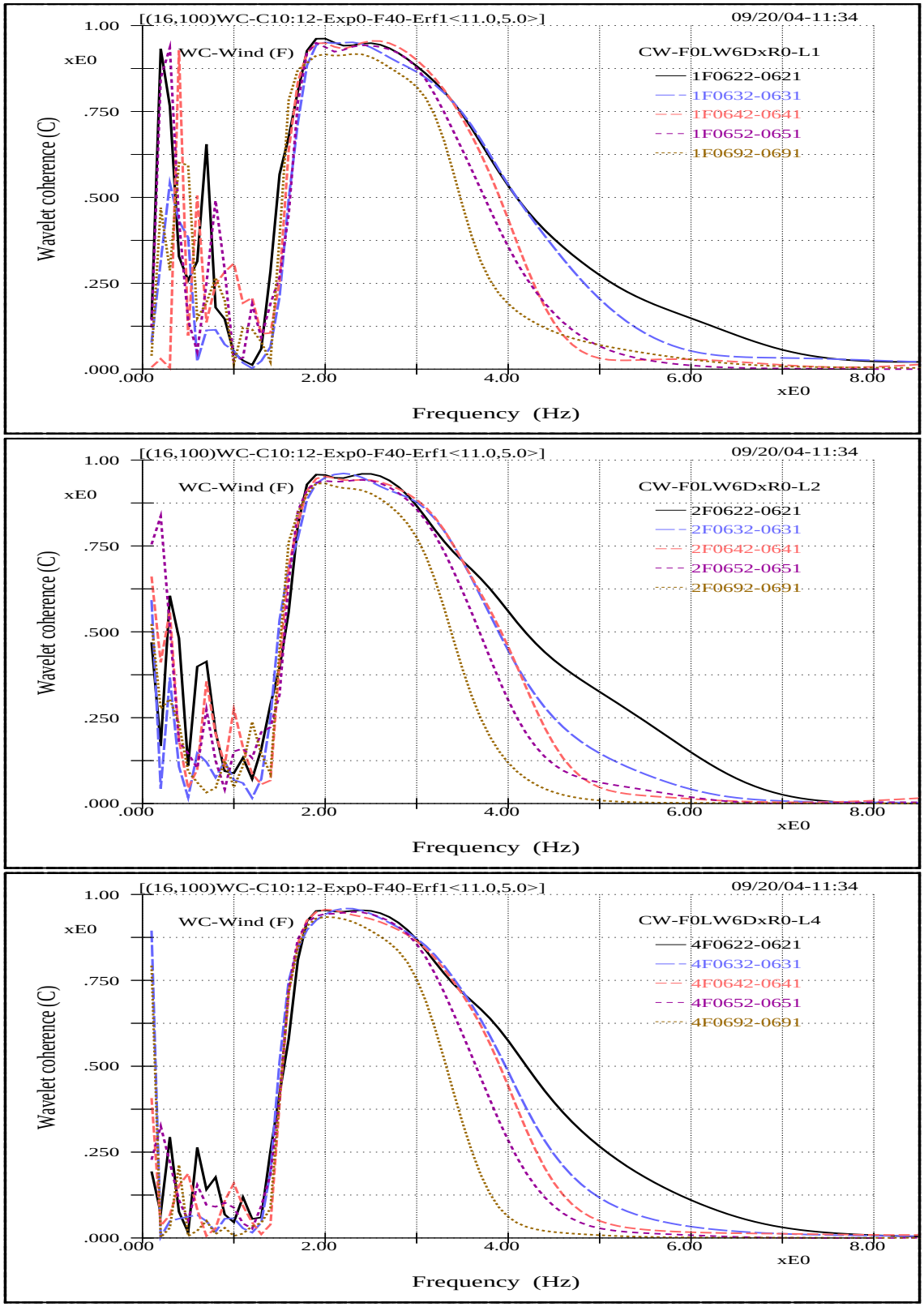


圖 6.1　三種資料長度下，波高與不同水深處水流間之仔波共關協振分佈曲線。上、中、下圖資料長度分別爲 1024、2048、4096 點。水速之量測點分別爲靜水面下 2、3、4、5、9 cm。

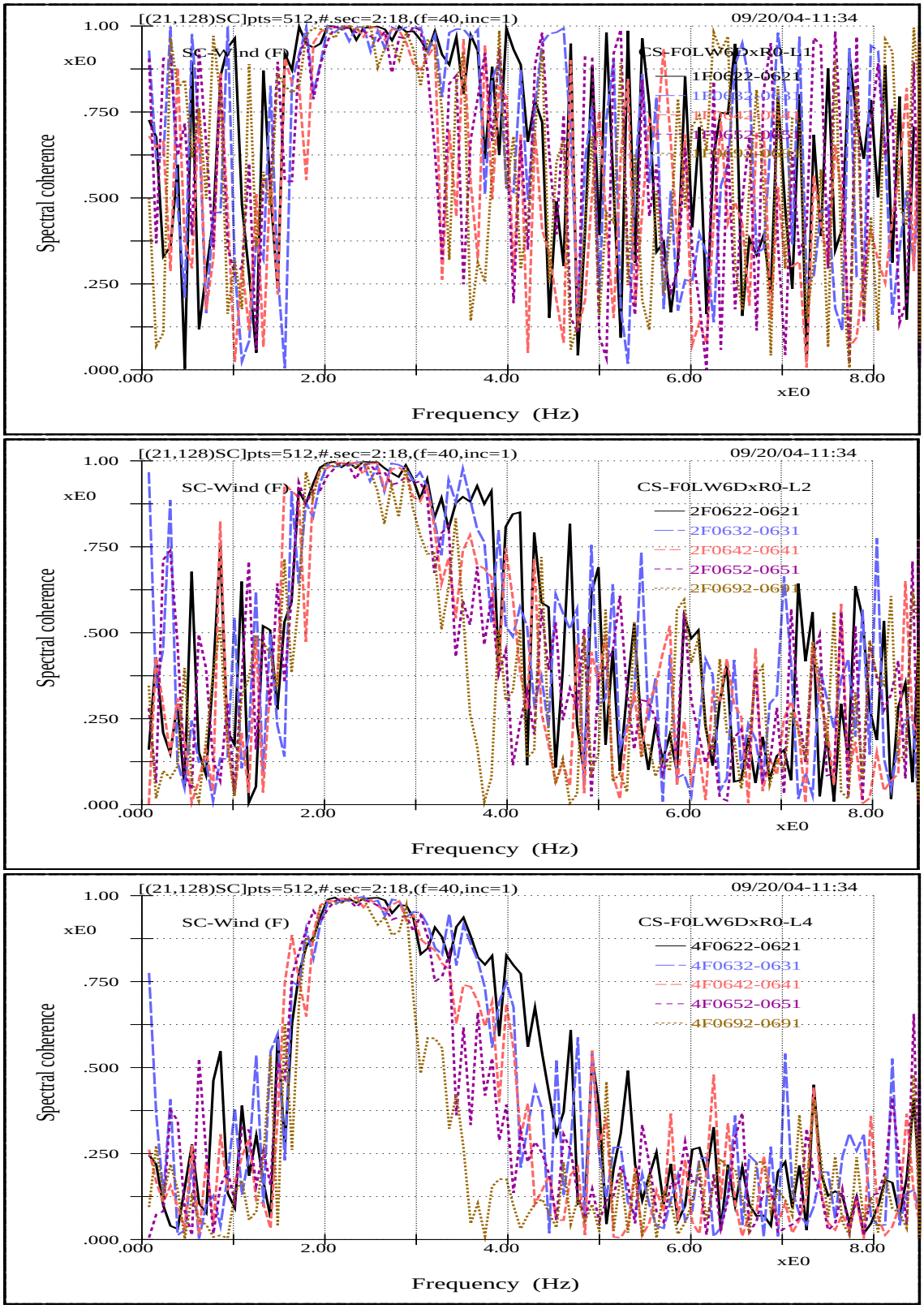


圖 6.2　三種資料長度下，波高與不同水深處水流間之波譜共關協振分佈曲線。上、中、下圖資料長度分別爲 1024、2048、4096 點。水速之量測點分別爲靜水面下 2、3、4、5、9 cm。此圖之 FFT 區段分割長度爲 512 點。

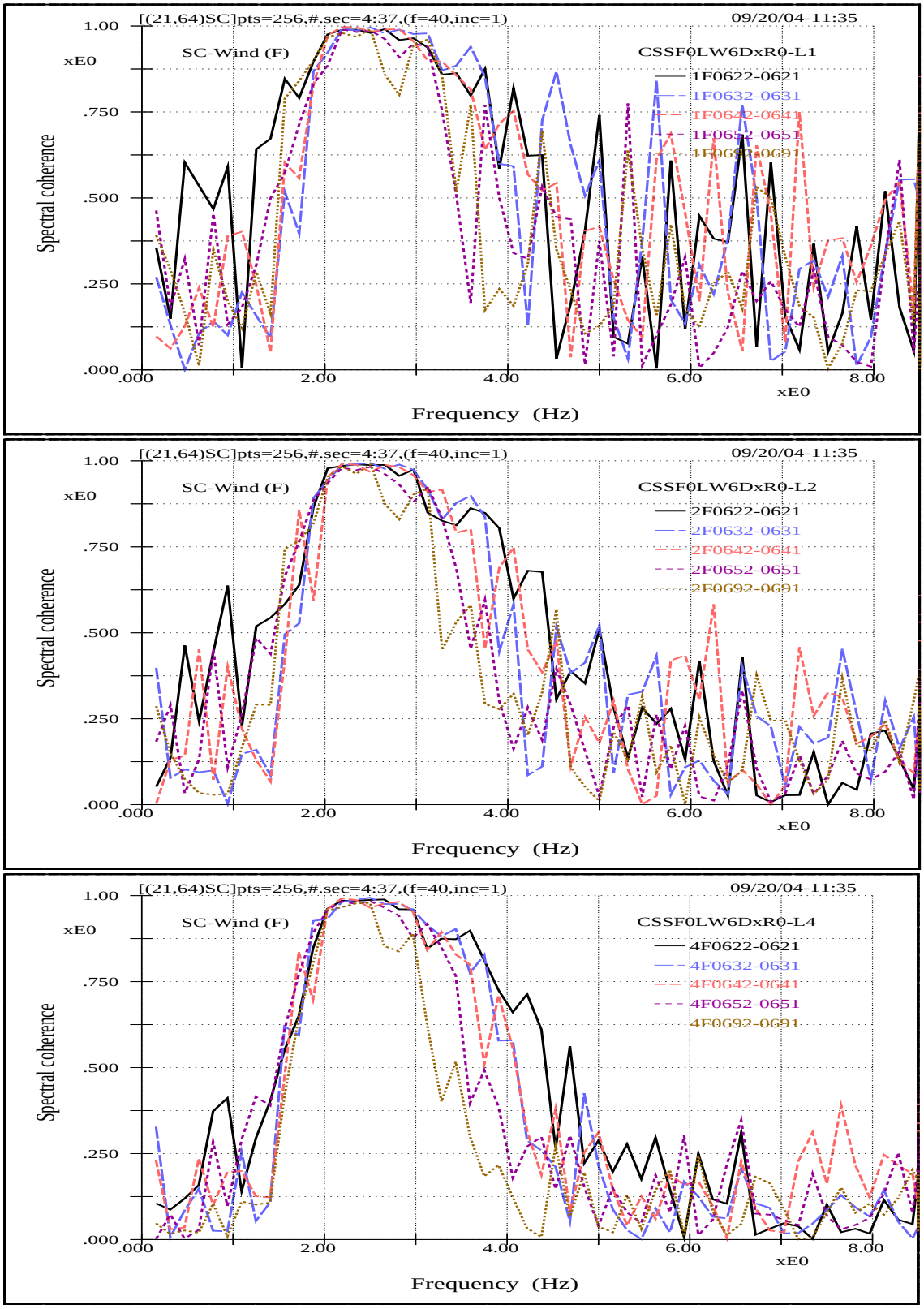


圖 6.3　三種資料長度下，波高與不同水深處水流間之波譜共關協振分佈曲線。上、中、下圖資料長度分別爲 1024、2048、4096 點。水速之量測點分別爲靜水面下 2、3、4、5、9 cm。此圖之 FFT 區段分割長度爲 256 點。

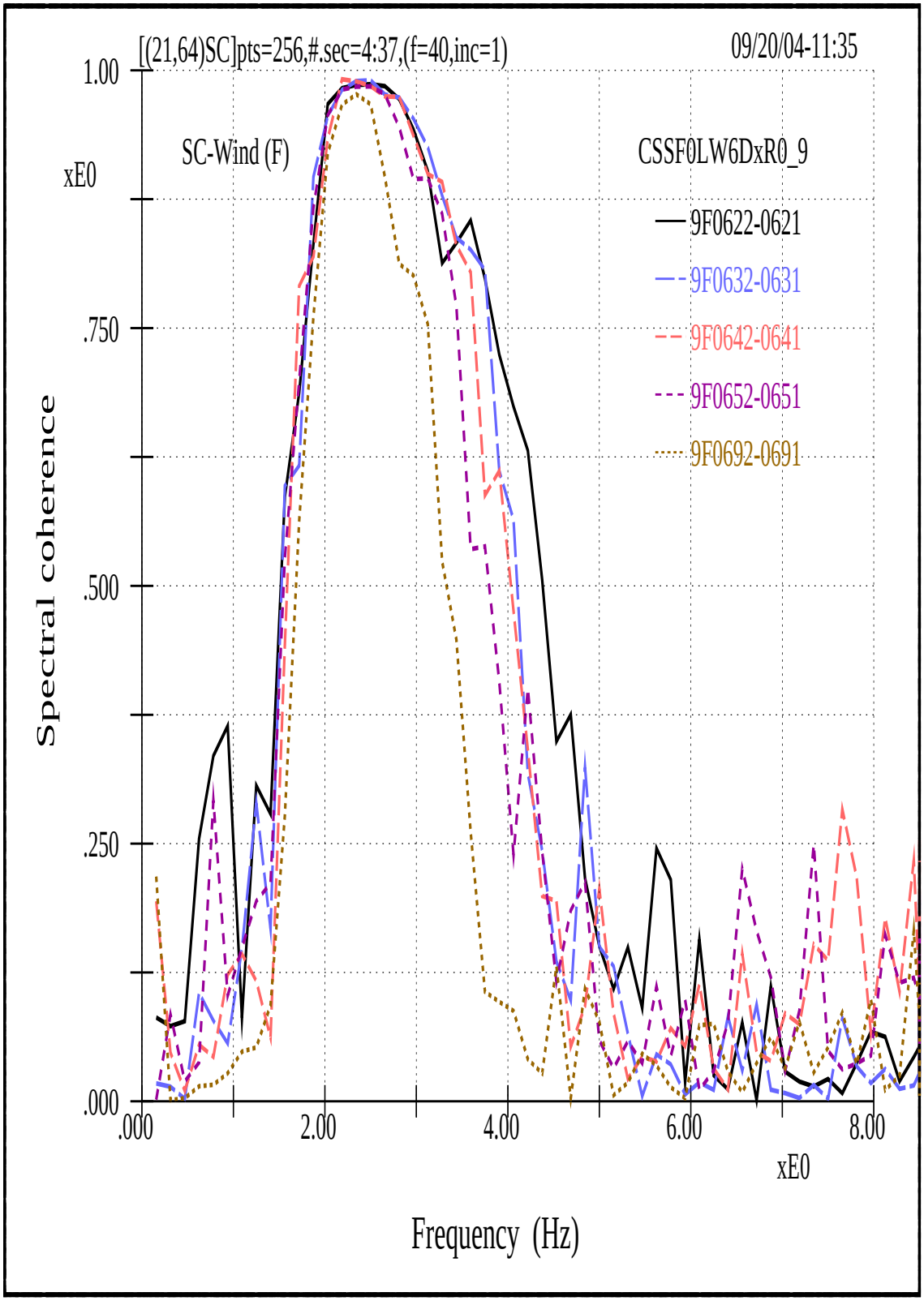


圖 6.4　資料長度爲 9472 點下之波譜共關協振。

第 7 章

類仔波

7.1 載頻物理

當我們想要應用仔波函基（wavelet basis）– 亦或是任何類型之函基（function basis）– 來研究某種物理現象時，其最爲基本，也最爲困擾的問題，就在於最適函數的選取。這當中的一個重要關鍵即在於如何將數學要義與物理探尋作最大程度之契合。數學源於定義，一點也不含糊，可是物理基於解說，而解說依人而論。解說之所以成立、其理得以接受之，必然是人們主、客觀所認定。把主觀最小化、客觀最大化，是爲科學的基本精神。在先前的研究中 [12] ，爲了尋取水波模擬或分析應用之最適仔波，我們從統計與數理雙方面，進行嚴謹之模擬檢核鑑取，再以實際之試驗資料加以多方面具體驗証，可說已立論最適仔波函基是爲半正交樞點順適仔波（semi-orthogonal cardinal spline wavelet）。

前述樞點順適仔波相應於水波特性所表現的優異性，我們也已指出其關鍵數理因子 [12]，也就是這一函基所特別具有的二個解析特性，即「全振性」與「全正性」 [2]。所謂的「全振性」是指母仔波函基函數具有完整的擺盪性，而沒有一些沒必要的中間起伏波動，或者說是所有波動都是越零位之完整性波動。而所謂的「全正性」，則是指函基父仔波（或比尺量度函數 scaling function）全支撐上的曲線分佈都是正值而沒負的。另這兩個特性亦相關於數理上的線性相位濾波（linear phase filtering）。而這種種特性，在物理義涵與實際應用上，在在表明，試驗水

波其時變性對絕大多數之仔波而言，都是相對非常柔順、緩慢變動的。此外，上述特性也代表下面兩種意象。其一，適當支撐長度、或者是適當生命週期的函基函數，是比較可能產生有義化之物理解說。其二，當輸入訊號有些許差異時，輸出之轉換結果不致於天差地遠、巨大變化，因爲唯有如此，研判上才較易理出頭緒，參數與狀況之關連比較可以預期及判讀，因而物理解說性較高 [9, 11, 16]。

另先前研究中我們亦表示，很幸運地，針對所鑑取得最適離散領域仔波，我們得以在連續仔波領域裡找到一個自然而然的對應仔波。而這一連續仔波就是莫利仔波。其所以稱幸運是大有緣由。因爲連續的莫利仔波與離散的半正交樞點順適仔波在數學理論上的根基可說毫無血源，可是，也因爲這一性狀對應關係，我們得以跳躍過抽象的尺度，從而進入具體而有物理關聯的頻率相關尺度，以及同樣具頻率關聯的仔波移位變量。此頻率關聯乃是，我們得以將莫利母仔波的波形衰減參數值與尺度變量值化成載頻（carrier frequency），從而引入豐富之物理探討性。

以上的說明是要述說：同樣地，如果此處類仔波（wavelet variant）不具有「載頻」這一物理相關性，那我們大概不用期待這一類仔波，在水波分析應用上會有什麼特別的出路。另一方面，這一類仔波及其數值手法當然也是一個屬於純數學的工具，不是一定要用於水波。

7.2 類仔波（wavelet variant）

在許多仔波轉換應用裡，其所涉仔波函數或函基是僅爲實函數，這也意味著在一些應用中相位訊息用處可能不大，亦或表示他們的訊號本質跟波譜中頻率所要表現的特質有甚大差異。可是對水波而言，頻率可說是核心對象，息息相關於所有的物理，也因此我們對水波之研究工具免不了要牽涉到相位。一個實數訊號雖然可以化成實數振幅及實數相位分佈之乘積，但這種轉換方式具有無窮組合，所以一般而言，可以有兩種處理方式，一是把實數訊號運用解析訊號流程（analytic signal procedure）化爲唯一型的複數解析訊號（analytic signal），另一是採用具有解析訊號型態之複數轉換函數。

莫利仔波是一具有解析訊號型態之複數轉換函數，而此處所提之類仔波可說變易於莫利仔波。此外一些探討標的亦涉及解析訊號流程運作。考量這一因素，我們當以莫利仔波爲基準對比項目，以下說明此類仔波之定義及其可探析型式。

類仔波其具有母仔波（mother wavelet）義涵的源頭函數 $\psi(t)$ 定義爲

$$\psi(t) = \frac{1}{\pi^{\frac{1}{4}}} \left[\operatorname{sgn}(t) \sin \omega_0 t - i \cos \omega_0 t \right] e^{\frac{-t^2}{2}}. \tag{7.1}$$

式中 ω_0 乃相關於蓋博轉換之調變頻率（modulation frequency）參數，$\operatorname{sgn}(t)$ 爲符號函數（sign function），而時變指數分佈是一高斯分佈罩窗（Gaussian envelope）。另式中定常係數是爲配合莫利仔波常規化（unit norm）之定常係數。而莫利仔波是爲

$$\psi(t) = \frac{1}{\pi^{1/4}} (e^{-i\omega_0 t} - e^{-\omega_0^2/2}) e^{-t^2/2}. \tag{7.2}$$

上兩式之主要差異在於符號函數之存在，及忽略了莫利仔波的微量改造項。圖 7.1 示此處類仔波之實部與虛部分佈曲線，圖 7.2 則示莫利仔波者。另此類仔波之縮放及移位版本是爲

$$\psi_{a,b}(t) = \frac{1}{\sqrt{a}\pi^{\frac{1}{4}}} \left[\operatorname{sgn}(t) \sin \omega_0 \left(\frac{t-b}{a} \right) - i \cos \omega_0 \left(\frac{t-b}{a} \right) \right] e^{\frac{-(\frac{t-b}{a})^2}{2}}, \tag{7.3}$$

式中 a 爲尺度變數，b 爲移位變數。而 $\frac{\omega_0}{a}$ 是爲反應尺度之載頻物理量，亦且是全文之核心探討對象，本章中所有的圖，其所出現之「尺度」或「頻率」都是指這一載頻物理量。

7.3 類仔波模值與相位

離散仔波轉換應用裡，例如在電子工程上許多影像處理，其轉換函基種類大致不出下述幾類，正交、交正交、半正交、及仔波包（orthogonal, bi-orthogonal, semi-orthogonal, wavelet packets [2, 5, 19, 21, 24]）。而這諸多離散轉換應用中，基本上都只有轉換模值之結果而不涉轉換相位，亦即都是用實數函基，無涉虛部訊

息。而即使是以複數莫利仔波所求取得之轉換相位，亦甚少見其著墨者，蓋其「直接」用處甚難簡易辨識。唯此處所提之類仔波，不但其模值具探討價值，其相位也同具豐富訊息與簡易辨識。此外這一類仔波其模值與相位尙可給予不同型式，產出不同訊息。

設若 $f(t)$ 爲所欲分析之訊號，則轉換模值 $|Wf(a,b)|$ 依據有如下之幾種方式：

$$Wf(a,b) = \langle f(t), \psi_{a,b}(t)\rangle, \tag{7.4}$$

或

$$Wf(a,b) = \langle f(t), \mathbf{I_m}\psi_{a,b}(t)\rangle + i\mathcal{H}\left[\langle f(t), \mathbf{I_m}\psi_{a,b}(t)\rangle\right], \tag{7.5}$$

或

$$Wf(a,b) = \langle f(t), \mathbf{R_e}\psi_{a,b}(t)\rangle + i\mathcal{H}\left[\langle f(t), \mathbf{R_e}\psi_{a,b}(t)\rangle\right]. \tag{7.6}$$

式中 $\mathbf{R_e}$ 與 $\mathbf{I_m}$ 分別表實部與虛部，$\langle,\rangle$ 表內積，$\mathcal{H}$ 則代表取希伯轉換（Hilbert transform）。式 7.4 爲常規轉換方式，亦是此類仔波較爲突顯的模值能量密度分佈型式。式 7.5 等同蓋博類型仔波轉換亦或等同簡化型態之莫利仔波轉換。而式 7.6 則可視覺上產出近似式 7.5 的密度分佈型態。.

另類仔波轉換之相位時尺分佈 $\phi(a,b)$ 爲：

$$\phi(a,b) = \tan^{-1}\frac{\mathbf{I_e}\langle f(t), \psi_{a,b}(t)\rangle}{\mathbf{R_m}\langle f(t), \psi_{a,b}(t)\rangle}, \tag{7.7}$$

或

$$\phi(a,b) = \tan^{-1}\frac{\mathbf{I_e}\langle f(t), \psi_{a,b}(t)\rangle}{\mathbf{R_m}\langle f(t), \psi_{a,b}(t)\rangle} + \frac{\pi}{2}. \tag{7.8}$$

式 7.7 爲常規定義式，亦是此類仔波之相位時尺分佈主要呈現方式。式 7.8 乃將式 7.7 作一 90 度之旋轉，主要是可彰顯頻漏渲染分佈。另式 7.6 亦可提供一相位呈現方式如下

$$\phi(a,b) = \tan^{-1}\frac{\langle f(t), \mathbf{R_e}\psi_{a,b}(t)\rangle}{\mathcal{H}\left[\langle f(t), \mathbf{R_e}\psi_{a,b}(t)\rangle\right]}. \tag{7.9}$$

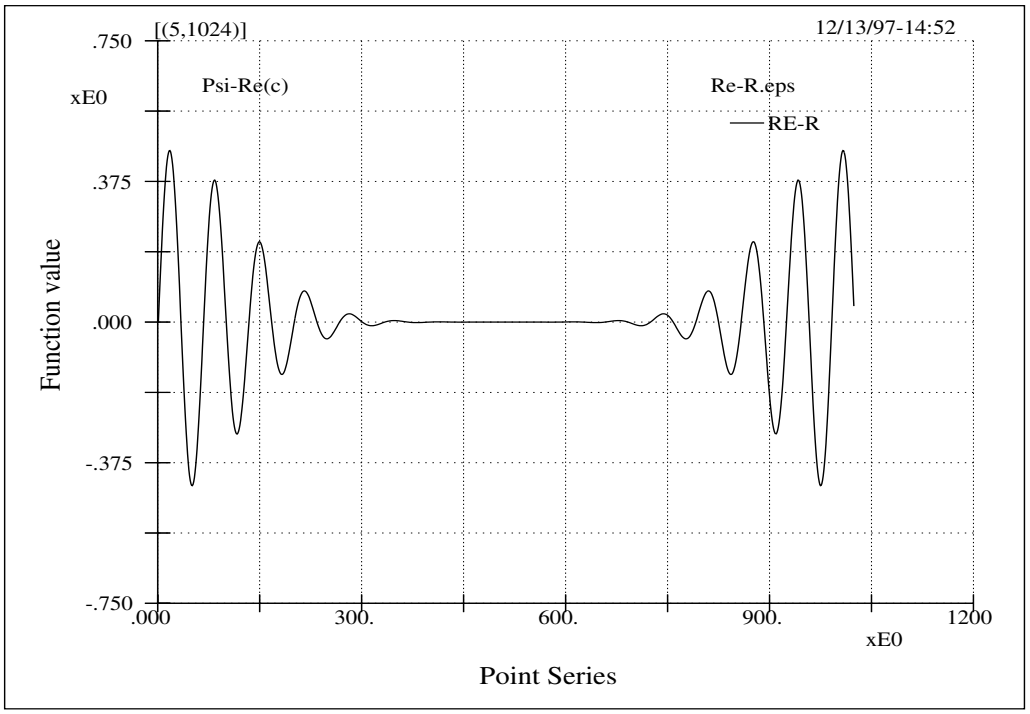
由以上定義得知，此處之主要數值方法基本上類似於連續仔波轉換。圖 7.3、7.4、7.5 示莫利仔波與此處類仔波之模擬比較。由圖可以輕易識別出此類仔波之優點。

此處類仔波相關 Asyst 程式爲

- `S_WVT.shl` ➲
- `LLet-WVT.asy` ➲

另相關 Mathematica 程式爲

- `TFR-WV_Shell` ➲
- `TFR-WV_Stand-alone` ➲
- `Wavelet-Variant-Characterizations` ➲ ❖



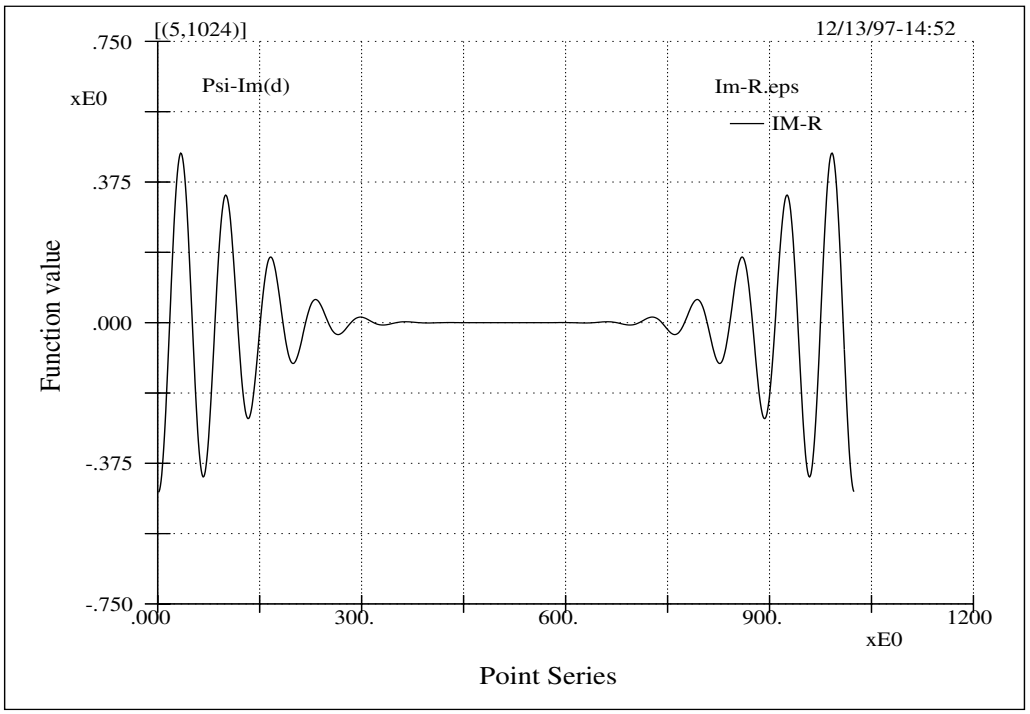
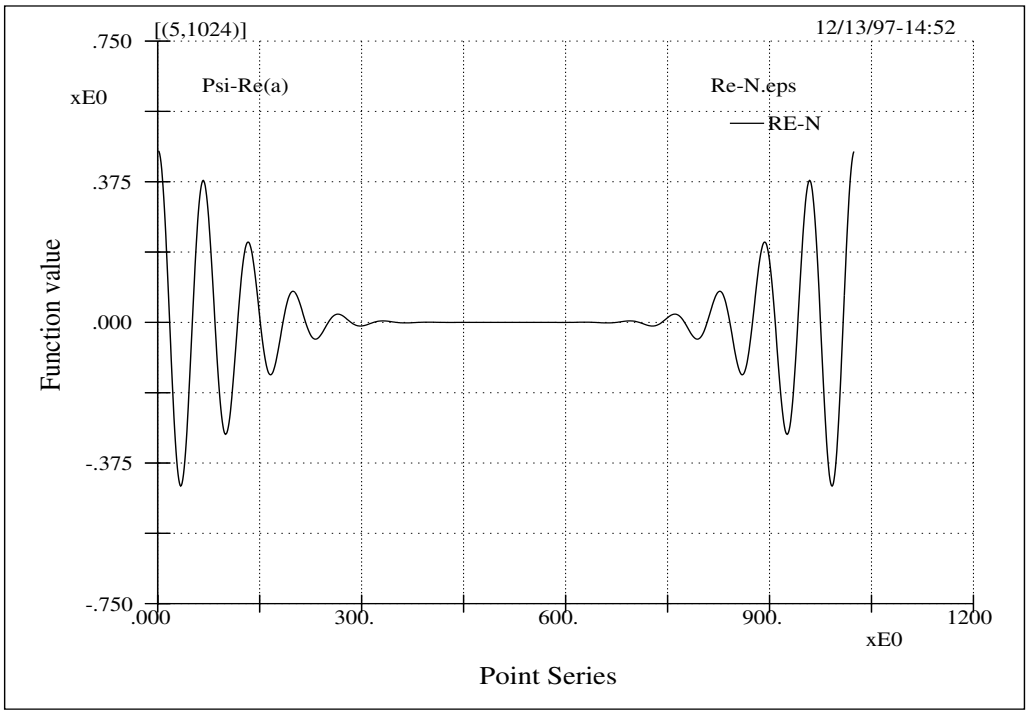


圖 7.1　本文所提類仔波其實部與虛部之函數分佈圖，其實部與虛部均爲偶函數。另此一函數並非解析函數（analytic signal）。



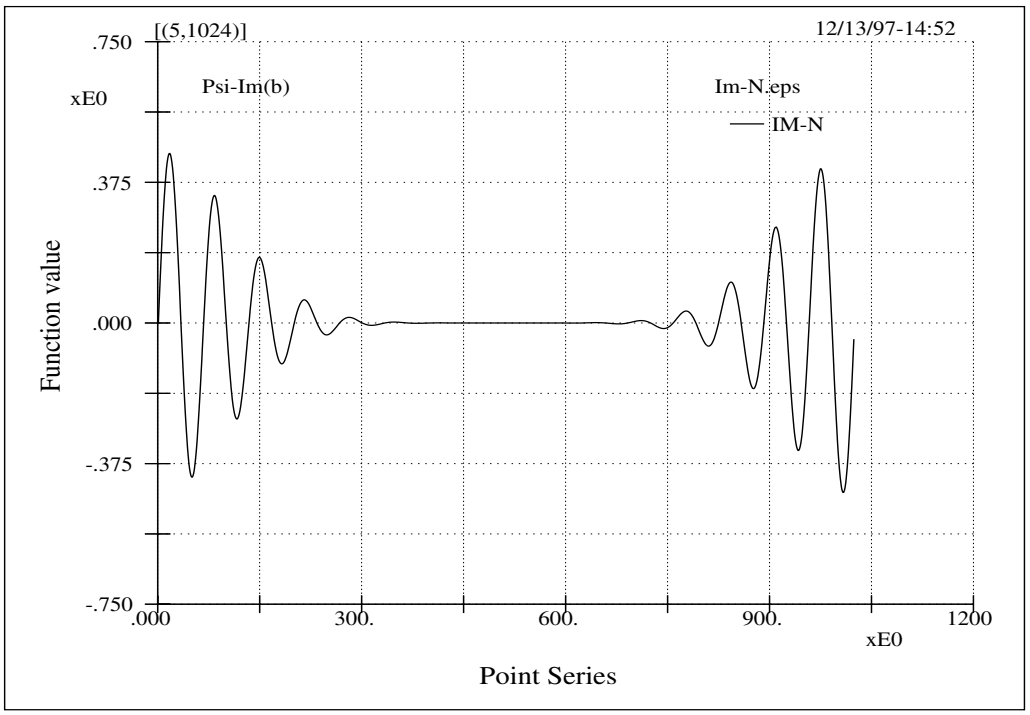


圖 7.2　蓋博類型仔波（Gabor wavelet）亦或是簡化型之莫利仔波（Morlet wavelet）其實部與虛部之函數分佈圖，而實部與虛部分別爲偶函數與奇函數。此一仔波有二個優良特點：其一，即其甚爲近似解析函數（analytic signal），設若其載頻不是很低；其二，其時頻窗面積接近於海參堡不定性之極限值。

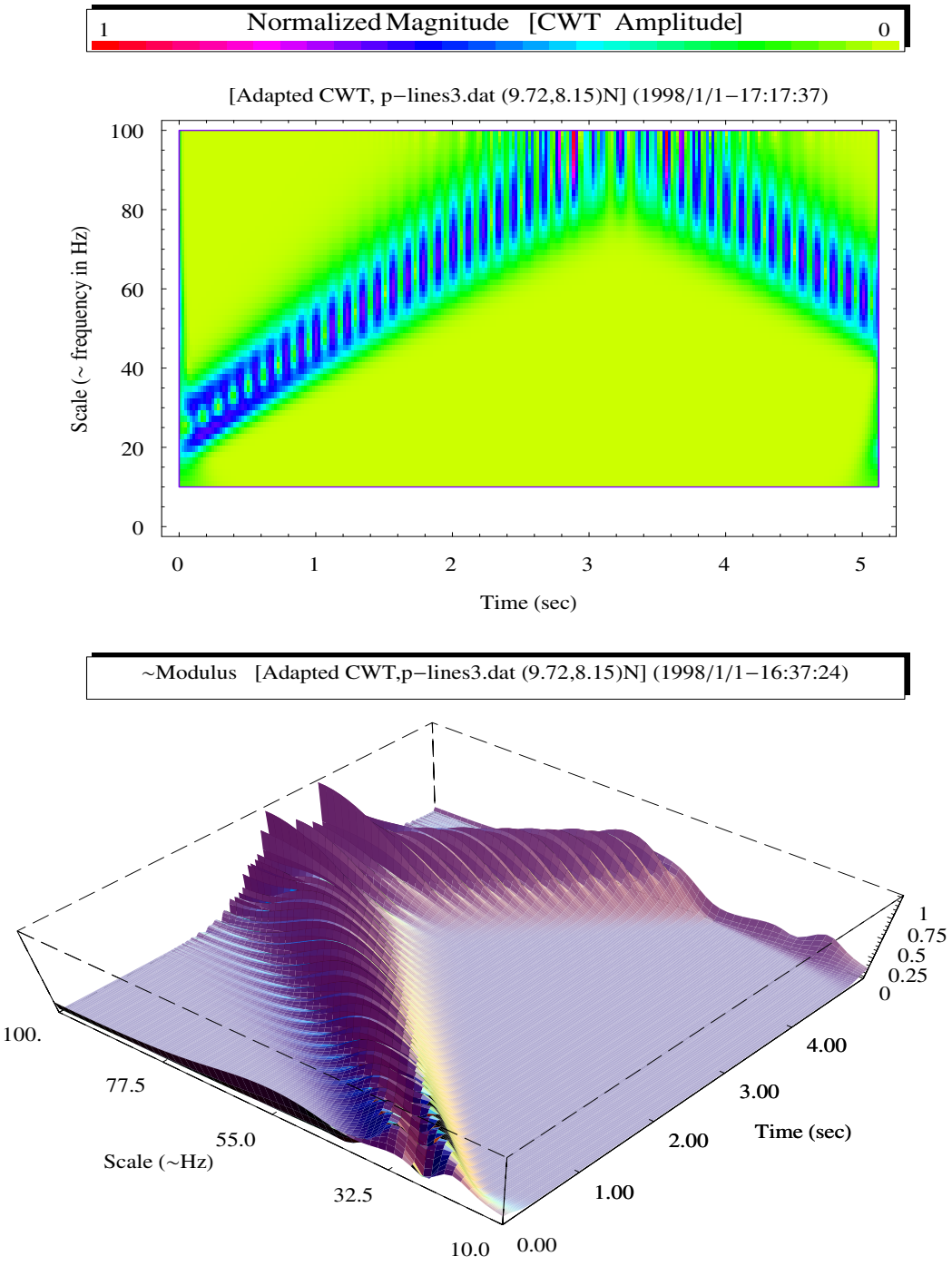


圖 7.3　此圖所用訊號係由一對等能量之平行線性漸高頻合成訊號，其兩線間之頻率差距爲十分之一尼克斯率（Nyquist rate）。此圖係由蓋博（Gabor）類型仔波所得模值分佈，其所提供之訊息可說是完全誤導，無法判定成分波。

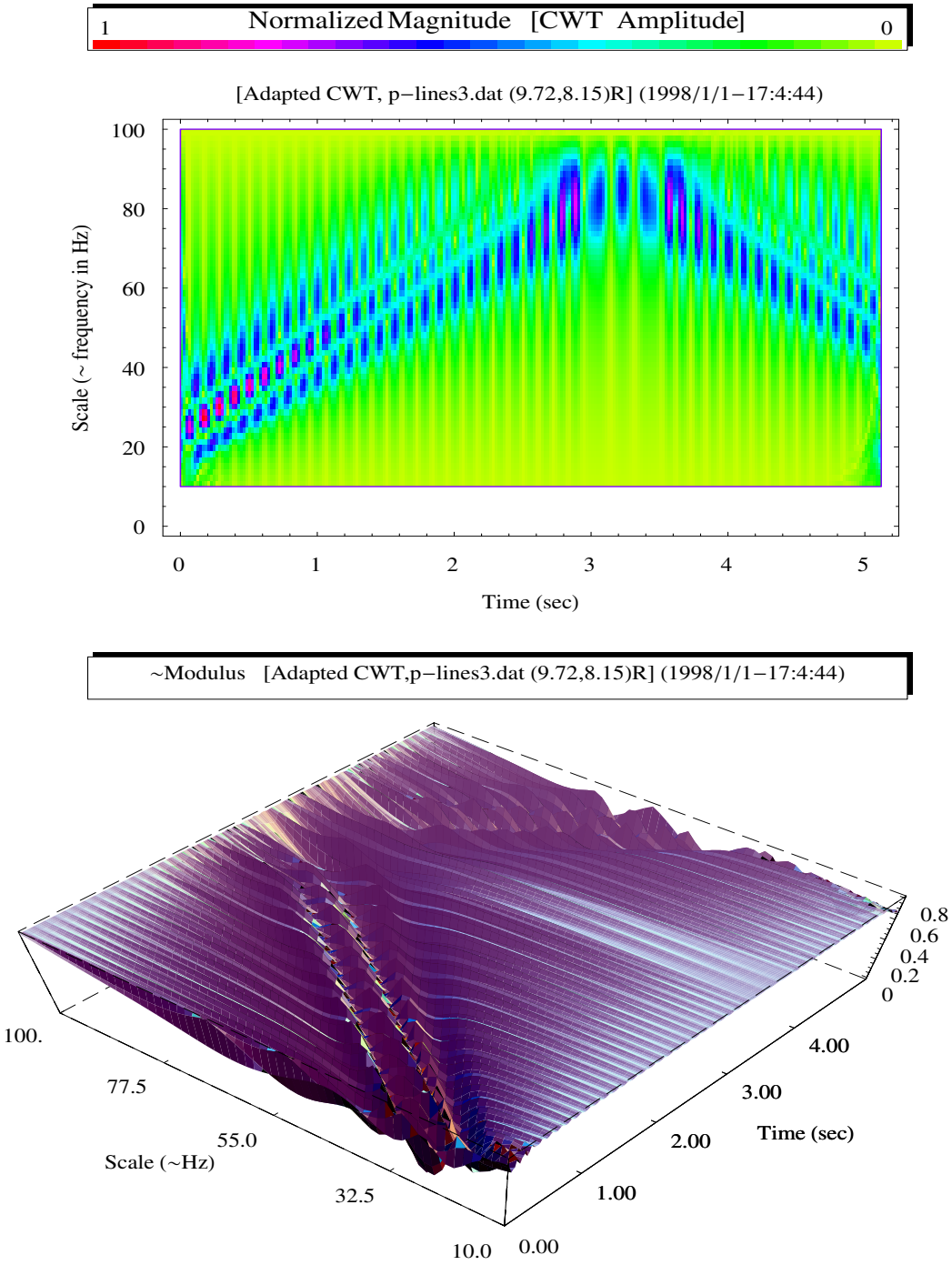


圖 7.4　相同於前一圖之平行訊號下其類仔波所得模值分佈，由圖可以輕易識別出兩平行訊號。

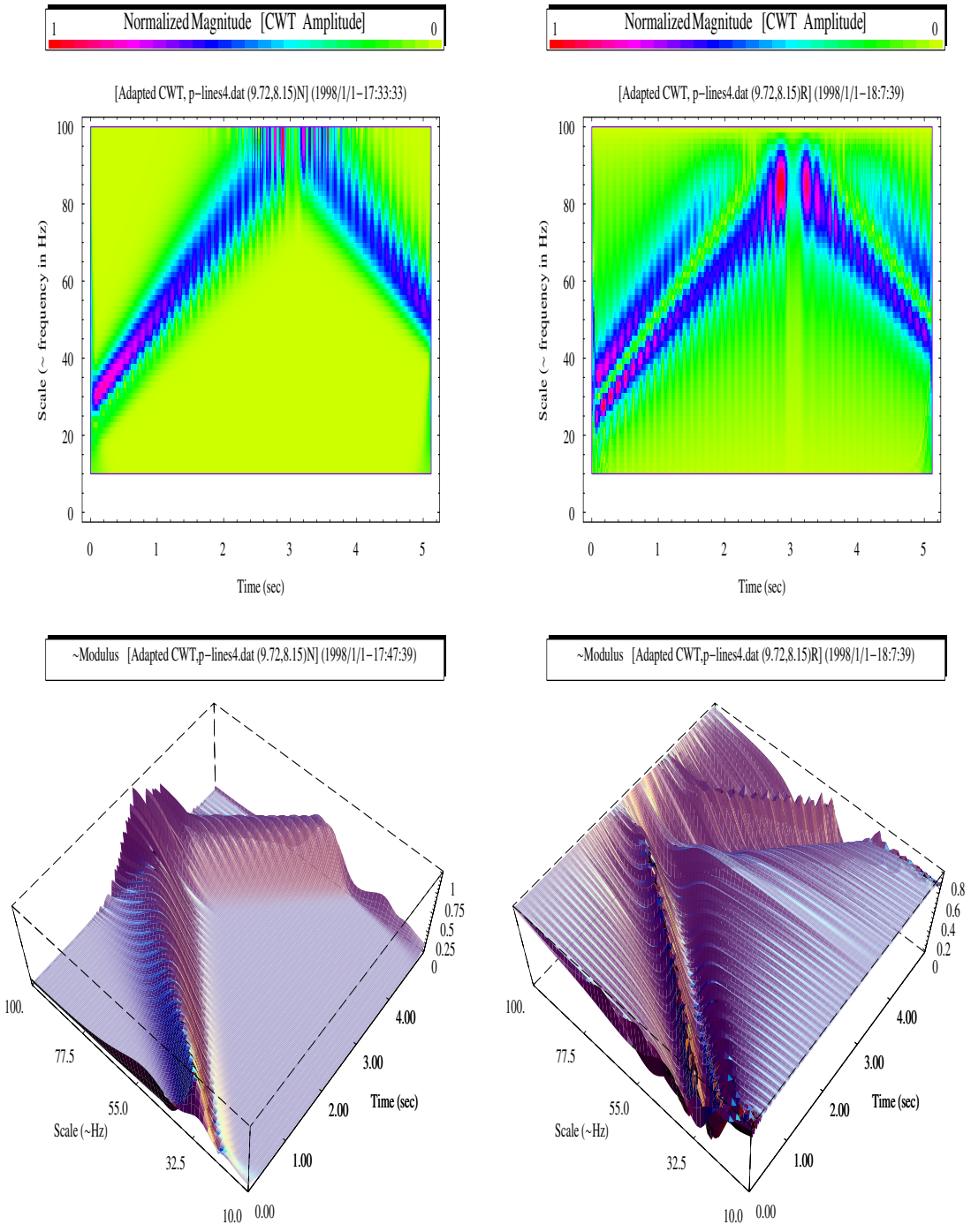


圖 7.5　此圖所用訊號係由一對不等能量之平行之線性漸高頻合成訊號，其兩線間之頻率差距仍爲十分之一尼克斯率（Nyquist rate），但兩成分訊號之能量比爲 0.04。此一能量差異在兩種轉換下，其低能量成分均被模糊效應所掩蓋，以致無從分辨。但就類仔波而言，仍得識其主能量訊號。反觀蓋博仔波者，只在大尺度區有明確顯示，而在小尺度區（高頻區）則甚差，亦即些微能量卻帶來嚴重汙染。

第 8 章

希伯轉換與解析訊號

8.1 複數訊號

量測得的原始訊號必然屬於實數，然而單純實數的用途似乎有限，如果我們得以取得一個與它「適當」對應的虛數數據，而由兩者合成一個複數訊號，那想像空間將可大爲擴展，而可能的物理視野也會更寬廣，另隨之而生的研究議題也將更多元豐富，但這種種或許也將帶來紛紜與困擾，這正也是時頻分析其有趣亦且棘手之處。

設若實數訊號爲 $s_r(t)$，其搭配的一個虛數訊號爲 $s_i(t)$，而兩者形成的複數訊號爲 $z(t)$，這一複數函數讓我們得以求取振幅 $a(t)$（amplitude，亦或模值 modulus）與相位 $\phi(t)$，而一般自然定義的瞬間頻率 $\omega_i(t)$ 是相位的導數或微分。即

$$z(t) = s_r(t) + s_i(t) = a(t)e^{i\phi(t)}, \tag{8.1}$$

$$\omega_i(t) = \phi'(t). \tag{8.2}$$

當然此處我們首先遇到的問題是：何者是「合理」或「適當」的對應虛部。因而至今，大家的普遍看法是：何者是恰適的複數訊號仍是一個開放性、爭議性的課題。如是，現時情況認知大概只能說是：

- 許多訊號分析研究者把「瞬間頻率」視爲一種原素概念（a primitive concept）而非數學定義。

- 個別定義或設定其出發點往往只在匹配研究者的直覺或主觀思維。

- 分析結果的物理性如何，還有，這些解說是否只是研究者的自我邏輯或推論而已。

- 所設複數訊號處理下來是否會帶來其它各式各樣的問題，或衍生出新的棘手課題，甚至於導出結果與原始認知有相衝突的情形，亦或與出發點的直覺兜不攏。

- 切要的說，理論與應用間存在有投機與隨機的成分。

8.2 解析訊號

基本上複數訊號的給定是屬一種相位正交模式（quadrature model），而解析訊號則可算是其中的一個特殊處置方式。

任何實數訊號 $s(t)$ 必皆可以表爲

$$s(t) = a(t)\cos\phi(t). \tag{8.3}$$

在正交模式下其最簡單直覺的複數訊號 $z(t)$ 爲

$$z(t) = a(t)e^{i\phi(t)}. \tag{8.4}$$

式 8.3 的基本問題是在其唯一性上，且其表示法無窮多，因而衍生的複數訊號有無限種。

蓋伯（Gabor）於 1946年所提出的複數訊號是爲解析訊號（analytic signal）[6]，其基本出發點是去除實數訊號富立葉轉換必然產生的負頻率分佈

現象，因此他把複數訊號 $z(t)$ 給定如下：

$$\begin{aligned} s(t) &\iff S(\omega), \\ z(t) &= 2\frac{1}{\sqrt{2\pi}}\int_0^\infty S(\omega)e^{i\omega t}d\omega. \end{aligned} \tag{8.5}$$

式中 $S(\omega)$ 是爲訊號 $s(t)$ 的富立葉轉換，而係數 2 之引入則是爲使複數訊號的實部得以等於原始訊號。這一給定具唯一性，其處理一般稱爲解析訊號流程（the analytic signal procedure）。很顯然的，上式複數訊號是爲實數訊號的單側波譜的富立葉反轉換。也就是說，如果將原始訊號的富立葉波譜之負頻率捨去，但保留完整的正頻率分佈，則這一單側波譜對應的就是實訊號的解析訊號，即此一波譜的富立葉反轉換就只有正頻率成分。而如此定義下的複數訊號相當符合吾人之喜好，因爲負頻率的東西很抽象，它最好是不存在，正如時間只有往前行，沒有往後走的。

今爲剖析這一解析訊號的「解析」特質，了解其行爲的相關脈絡，看看它可以提供那些物理信息，亦或存在某些拘限性，我們從基礎出發，研究其數學根本。也如是，我們很自然的會看到解析訊號與希伯轉換的密切關係。

8.3 希伯轉換

前述解析訊號可以表爲：

$$z(t) = \mathcal{F}^{-1}\left\{S(\omega) + S(\omega)\mathrm{sgn}(\omega)\right\}. \tag{8.6}$$

而由富立葉轉換其兩對應領域上互爲存在的雙向可行的特色運算關係，即一領域的乘積（product）在對應領域上是爲旋移乘積（convolution），可得：

$$z(t) = \mathcal{F}^{-1}\left\{S(\omega)\right\} + \mathcal{F}^{-1}\left\{S(\omega)\right\} \star \mathcal{F}^{-1}\left\{\mathrm{sgn}(\omega)\right\}, \tag{8.7}$$

$$z(t) = s(t) + i\left[s(t) \star \frac{1}{\pi t}\right]. \tag{8.8}$$

是故：

$$z(t) = s(t) + i\frac{1}{\pi}\mathcal{P}\int_{-\infty}^{\infty}\frac{s(\tau)}{t-\tau}d\tau. \tag{8.9}$$

式中 $\mathcal{P}$ 代表高斯主值（Cauchy principal value）積分，而其虛部是爲實數訊號的希伯轉換，即下式之 $\mathcal{H}[s(t)]$：

$$\mathcal{H}[s(t)] = \widehat{s(t)} = \frac{1}{\pi}\mathcal{P}\int_{-\infty}^{\infty}\frac{s(\tau)}{t-\tau}d\tau, \tag{8.10}$$

其中 $\mathcal{P}$ 表示爲對奇異點（singularity）的積分：

$$\mathcal{P}\int = \lim_{\epsilon\to 0}\left(\int_{-\infty}^{t-\epsilon_1} + \int_{t+\epsilon_2}^{\infty}\right), \tag{8.11}$$

此外 $\epsilon_1 = \epsilon_2$。今令：

$$f(t) = \frac{1}{t}, \tag{8.12}$$

並使用如下之富立葉轉換對應領域之正反雙重適用的運算特性對（the duality relations of the Fourier transform pairs）：

$$h(t) \iff H(\omega), \tag{8.13}$$

$$h(t) \star f(t) \iff H(\omega)F(\omega), \tag{8.14}$$

故得訊號之希伯轉換爲如下之旋移乘積式：

$$\widehat{s(t)} = \frac{1}{\pi}(s \star f)(t). \tag{8.15}$$

因而此希伯轉換之富立葉轉換爲：

$$\mathcal{F}[\widehat{s(t)}] = \widetilde{S}(\omega) = \frac{1}{\pi}S(\omega)F(\omega). \tag{8.16}$$

上式得以把 $S(\omega)$ 與 $F(\omega)$ 分開來，所以前述之主值積分就變成求取 $f(t)$ 之富立葉轉換問題如下：

$$\mathcal{F}[f(t)] = F(\omega) = \mathcal{P}\int_{-\infty}^{\infty} \frac{e^{-i\omega t}}{t} dt = \mathcal{P}\int_{-\infty}^{\infty} \frac{\cos(\omega t)}{t} dt - i\int_{-\infty}^{\infty} \frac{\sin(\omega t)}{t} dt. \tag{8.17}$$

上式中實部的積分內容具有反對稱性（antisymmetric），其主值積分爲零，而其虛部的積分內容則對稱分佈且無奇異點存在，蓋因 $\sin(\omega x)/x$ 對任何 x 都收斂於一個定值，即使是在原點 $x = 0$ 上也是。另由下式：

$$\int_0^{\infty} \frac{\sin \omega x}{x} dx = \mathrm{sgn}(\omega) \int_0^{\infty} \frac{\sin u}{u} du, \tag{8.18}$$

我們得知 $F(\omega)$ 基本上與 ω 上的波譜分佈狀況是無關聯的。即便如此， $F(\omega)$ 的求算仍必須應用複數微積分（complex calculus）中的餘數定理（residue theorem ）。經參考 Greenberg 所著教科書 [7] 實際推導可得下式：

$$F(\omega) = \begin{cases} -i\pi\,\mathrm{sgn}(\omega) & \omega \neq 0; \\ 0 & \omega = 0. \end{cases} \tag{8.19}$$

此式相當簡易，它只跟 ω 的正負性有關。是故吾人得証解析訊號 $\mathcal{A}[s(t)]$ 的富立葉轉換是爲下式；

$$\mathcal{F}[\mathcal{A}[s(t)]] = S(\omega) + i\mathcal{F}[\mathcal{H}[s(t)]] = \begin{cases} 2S(\omega) & \omega > 0; \\ 0 & \omega \leq 0. \end{cases} \tag{8.20}$$

再綜合檢視上些式子，亦得訊號其希伯轉換的富立葉轉換爲：

$$\widetilde{S}(\omega) = \begin{cases} -iS(\omega) & \omega > 0; \\ iS(\omega) & \omega \leq 0. \end{cases} \tag{8.21}$$

由以上的推導，我們亦可得知，希伯轉換實爲一乘積運算子（operator），其在頻率領域的作用有如下之運算作用：

$$O_H(\omega) = -i\mathrm{sgn}(\omega) = \begin{cases} -i & \omega > 0; \\ 0 & \omega = 0; \\ i & \omega < 0. \end{cases} \tag{8.22}$$

如是之故，希伯轉換是把負頻率的成分之相位移位正 90 度，並將正頻率成分之相位移位負 90 度。也因此，解析訊號其實部與虛部綜合的結果，就是只取出實數訊號之正頻率成分。

8.4 史脫克斯波調變

此處以最簡單的水波狀況，即以水槽之史脫克斯波其成分波傳播上的演化性狀，加以解說希伯轉換與解析訊號之瞬間頻率應用。這裡的史脫克斯波有不同尖銳度、不同線性或非線性尺度，但不論其大小，我們都將見到其時間上與傳播上的延途調變，即其成分波相位速度差異及整體性狀的變動跡象都是相當明顯。此些不同史脫克斯波包含四種，其個別基礎協調頻率分別爲 1.4、2.1、2.2、3.0 Hz，其能譜圖如圖 8.1 所示，另其基礎協調頻率是由帶狀濾波所得，而其尖銳度則由其各別的振幅調頻曲線求取，另其基礎協調頻率的尖銳度則個別爲 0.06、0.20、0.21、3.00。圖 8.2 以迄圖 8.5 表這些基載頻率及其協調頻率成分波的瞬間頻率變動曲線，包含其在歷時上的變化及在不同位置上（上、中、下游）的演化，由這些圖可見所有的成分波都具有變動性，即使是對尖銳度甚小的史脫克斯波亦然如此，此外越往下游其演化差異性也越明顯。

此處希伯轉換與解析訊號相關 Asyst 程式爲

- `HT-word.asy`
- `S_Mod.shl`
- `LMod-0.asy`

- `LMod-MP@asy` ❖

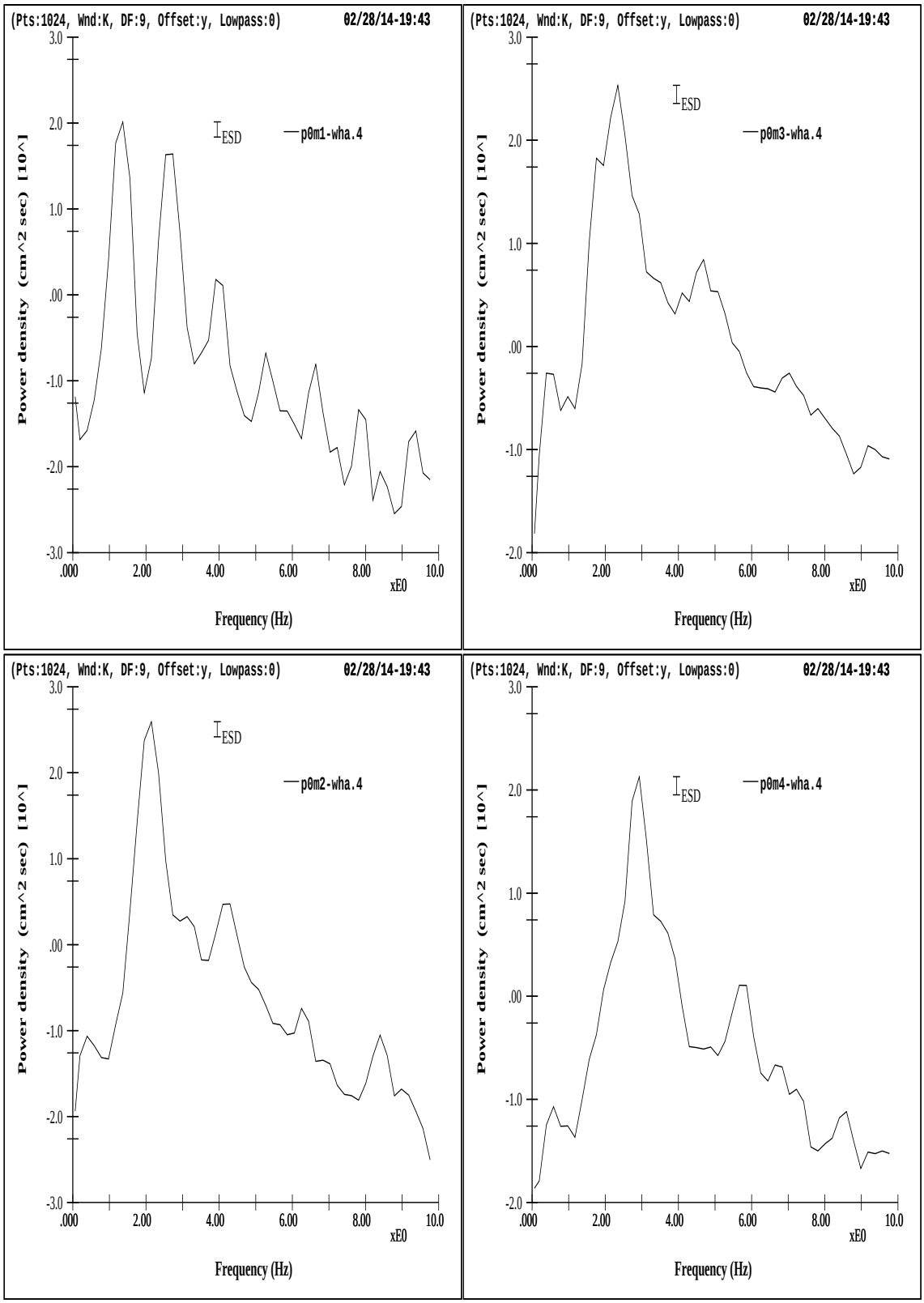


圖 8.1　此圖示四個不同基礎協調頻率之史脫克斯波之能譜。其四個基礎協調頻率分別爲 1.4（上左）、2.1（下左）、2.2（上右）、3.0（下右）Hz，而個別尖銳度則分別爲 0.06、0.20、0.21、3.00。

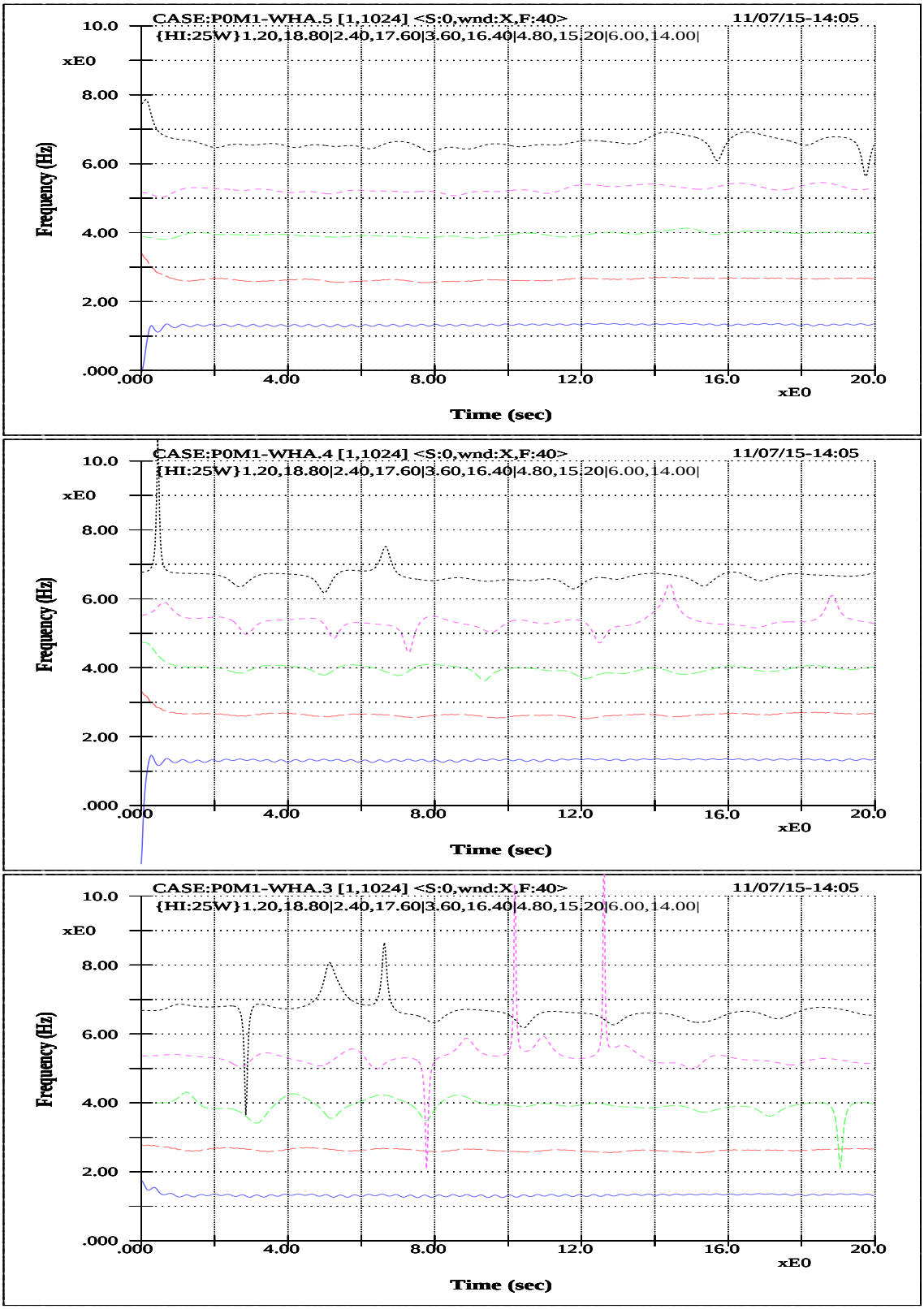


圖 8.2　此圖示基礎協調頻率爲 1.4 Hz、而尖銳度爲 0.06 之史脫克斯波其成分協調頻率之瞬間頻率在時間與空間上演化的性狀。上圖示上游的量測位置，離造波機之距離爲2.3 m；中圖爲中游者，離造波機3.5 m；下圖爲下游者，離造波機4.5 m。此波之尖銳度甚小，但有其時空上的演化，特別是高頻區帶。

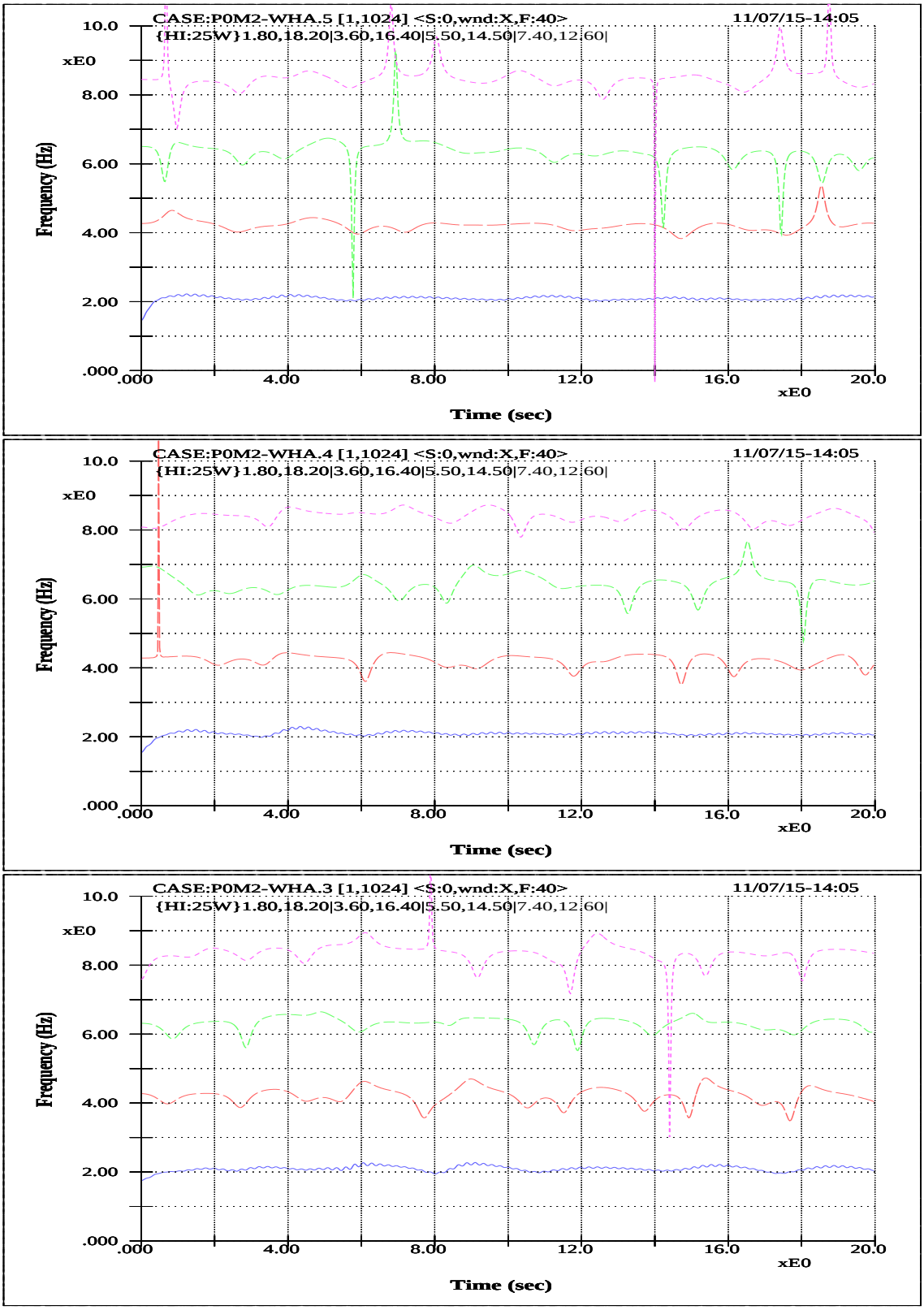


圖 8.3　此圖示基礎協調頻率爲 2.1 Hz、而尖銳度爲 0.20 之史脫克斯波其成分協調頻率之瞬間頻率在時間與空間上演化的性狀。上、中、下圖之量測位置同前。很顯然地，各成分由單純而驅於調變化。

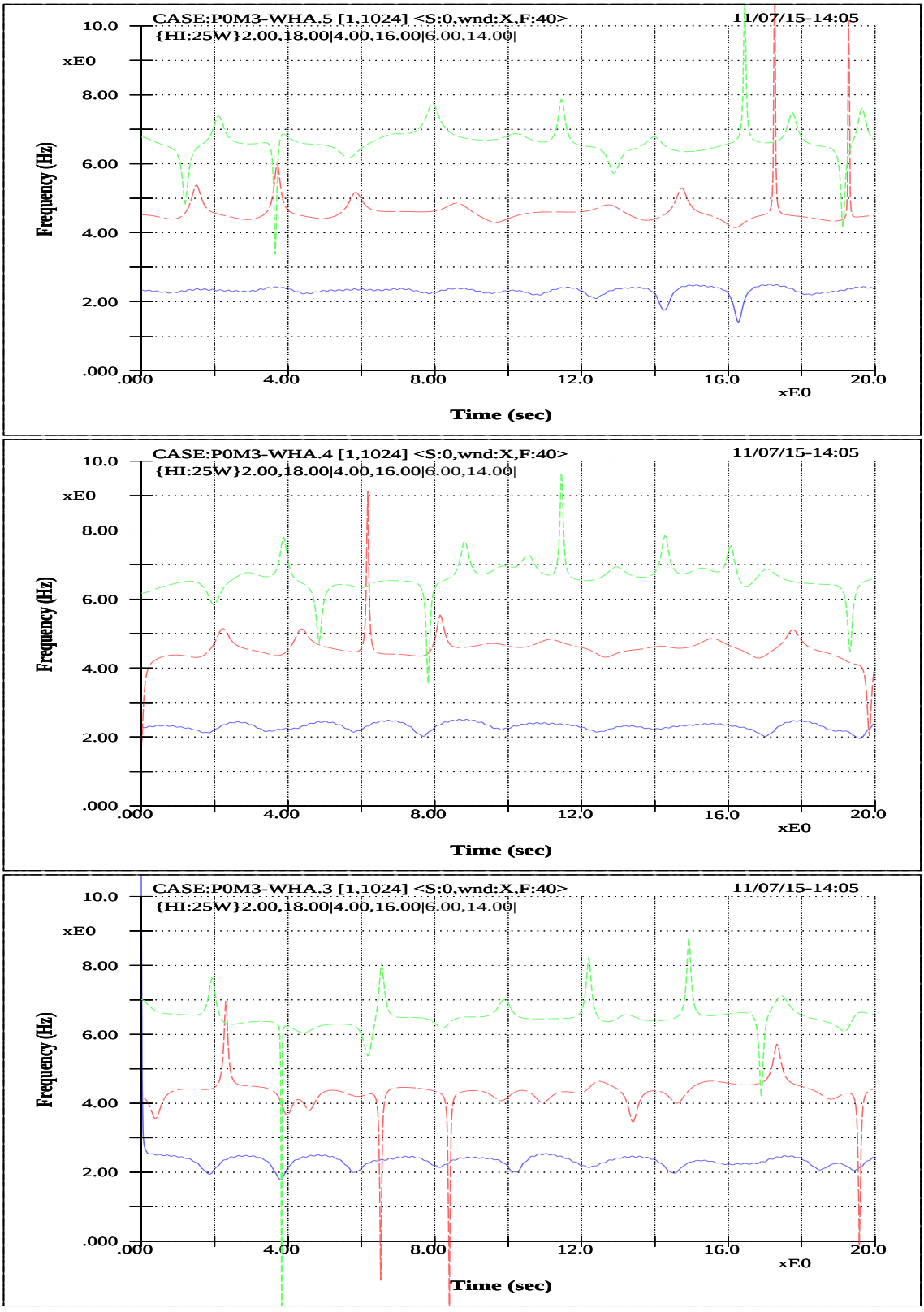


圖 8.4　此圖示基礎協調頻率爲 2.2 Hz、而尖銳度爲 0.21 之史脫克斯波其成分協調頻率之瞬間頻率在時間與空間上演化的性狀。上、中、下圖之量測位置同前。同樣地，各成分由單純而驅於調變化。此圖之基礎協調頻率與尖銳度均僅微大於前一圖者，但其性狀變動已明顯强烈。

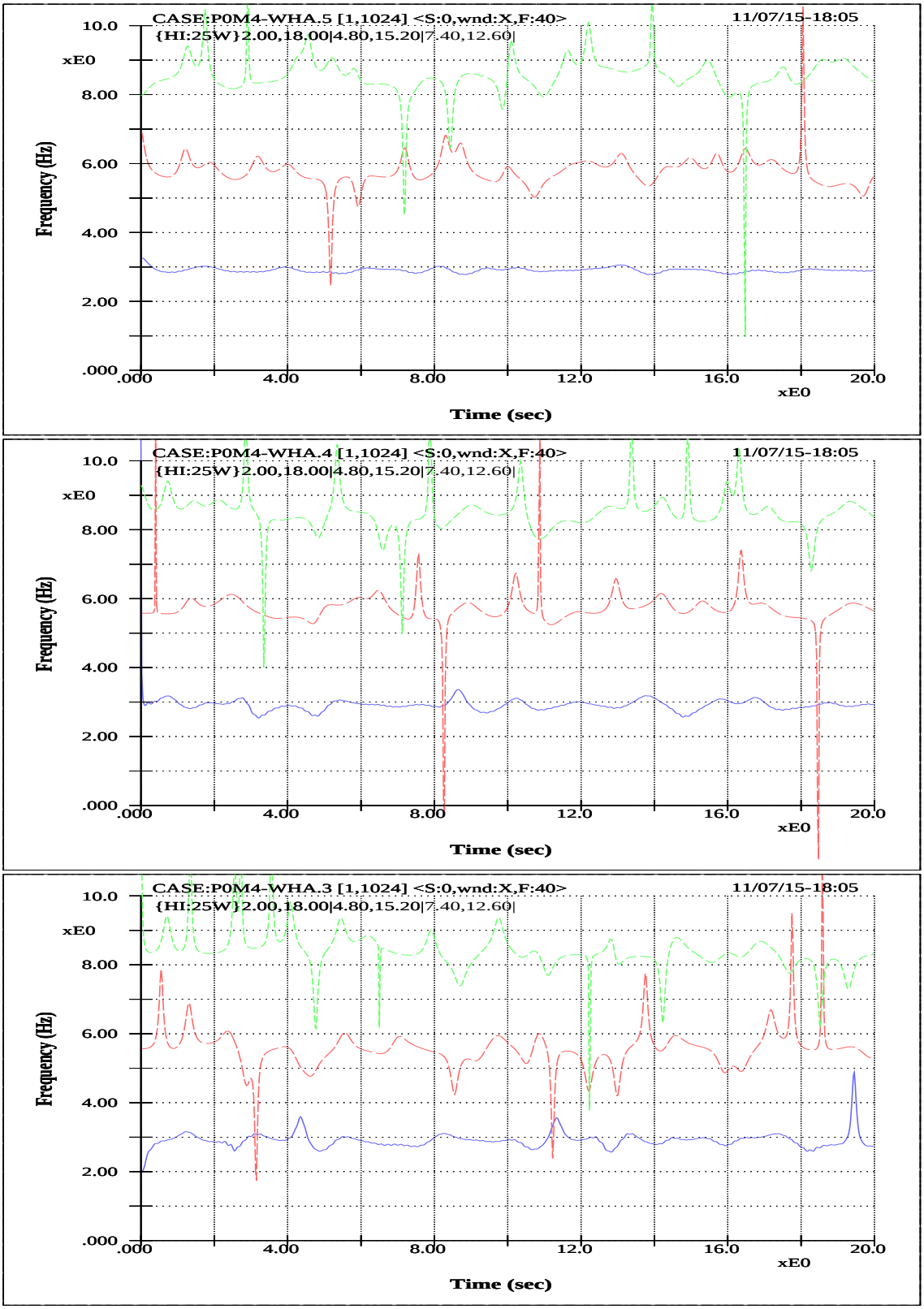


圖 8.5　此圖示基礎協調頻率爲 3.0 Hz、而尖銳度爲 0.30 之史脫克斯波其成分協調頻率之瞬間頻率在時間與空間上演化的性狀。上、中、下圖之量測位置同前。同樣地，各成分由較單純而驅於劇烈調變。此圖之基礎協調頻率與尖銳度均較前些者明顯爲高，其性狀變動在上游位置已較顯著，而其時間與空間上演化的性狀更爲激烈。

第9章

輔助程式與工作平台

9.1 引言

Asyst 語言是本研究所有分析的核心，但僅僅使用這一核心恐亦難以建構精確實在的研究結果。此處整合各類輔助或應用程式碼，開發撰寫工作平台系統建置資料、圖表、文件、報告等之處理、展示、列印、管理體系。科學化、系統化、自動化、無誤化是爲此處所有工作的基本原則。另外此章中亦說明相關程式運作的一些要求。

9.2 Asyst 疊置操作程序與記憶體管理

Asyst 語言建制在微軟的 DOS 業系統下，它屬於 FORTH 語言的一個分支，其突出特點主要爲 stack-oriented 及 reverse Polish notation（堆疊及回取）。它除了可以具有傳統編譯器的功能外，尚可行互動式累加編譯（interactive incremental compilation），具有優點如：即時定義，馬上疊加，分段載入，中間修改，立刻診察，中途檢視等。另外它的長處是「word」（相當於某些程式語言的 subroutine、subprogram）的使用，其便利性與彈性爲其優越之處。但這一系統的順利運作，除了語言本身外，主要關鍵尚有兩大因子須要考量，其一是軟硬體基本疊置操作程序（Overlay）載入之優化，另一爲記憶體之分配管理。Overlay 覆蓋程式是當需要的時候才將 Asyst 成分軟體載入到系統中，亦稱做「動態載入

（Dynamic loading）。記憶體之管理分配除了DOS 本身需有適當參數設定外，其相關者尚有各類型數據及變數（如： Symbol, String, Array, Unnamed Array, Token, Expended Memory Token, System Buffer, etc.），任一類型數據及變數記憶體一旦遇到不足的狀況，程式即會中止。這些程序及參數的設定相當惱人，需要不斷的試誤（try and error），費時甚多，往往不是三兩天的事。圖 9.1 及 9.2 示本研究之記憶體分配管理與疊置操作程序（Overlay）需求。另 DOS 系統之開機參數設定程式檔如：

- `P300-AUTOEXEC.bat`
- `P300-CONFIG.sys`

9.3 訊號集錄及即時分析

有理論分析程式也要有良好品質的原始資料，對資料的信心是最重要、也是最基本的要求。在建構這些較複雜的訊號分析程式之前，作者亦開發試驗室訊號集錄及即時基礎分析與視覺化展示之系統。本研究所涉資料均由這一系統取得。這一包含硬體控制暨涉及比較傳統分析之即時系統所含程式有：

- `Lee.men`
- `Acq.men`
- `pre-file.nam`
- `bell.txt`
- `def-winn.nam`
- `def-acqn.nam`
- `def-acqs.spe`
- `def-anan.nam`

- def-ana1.1sp
- lsta-0.txt
- lref-0.txt
- lwhp-0.txt
- lplt-0.txt
- mon.men
- cal.men
- lacq-spe.men
- lsta.hlp
- lplt.hlp
- lscr.hlp
- lref.hlp
- lwhp.hlp
- lpar.hlp
- llet.hlp
- lcal.hlp
- lacq.hlp
- LAnA.hlp
- lmon.hlp

9.4 附加程式

前處提到 Asyst 字語「word」的長處是其便利性與彈性，也正因這一優點，在程式集裡，處處可見作者自行給定，或一己所說的字語「word」。所以要了解此處的程式，除了要熟悉 Asyst 本身所提供的內建字語外，尚要知道那些是作者自創的字語。這也造成程式語言於研究人員間，難以溝通及缺乏親和力，及其對開發者本身，日後記憶之挑戰與維護之困難。此處吾人希望任何作者自行給定的字語均無一遺漏，而程式集具有公信，完整而可驗証。這些自創字語基本上可分成兩類，一類是大部分程式均可能使用的，或只出現於主程式中的。大部分主程式均可能使用的是以附加程式方式爲之在主程式一開頭就載入編譯，較少使用的附加程式則隨需求載入。一般一開頭就載入的附加程式是相應於硬體屬性、互動式用途字語、螢幕即時展示設定與規劃、色調圖線偏好使用、字串與數字串轉換、檔案或矩陣輸出、等。另一些需求式載入程式主要如製作高品質 EPS 圖檔（encapsulated Postscript figure）及報表檔案（spreadsheet）產出。這些程式有

- `Lee-Word.asy`
- `123-A2W.asy`
- `FigA-Ini.asy`
- `FigAPlot.shl`
- `FigAPlot.asy`

9.5 工作平台開發

前面述及程式語言之難以溝通及缺乏親和力，亦且維護困難、挑戰記憶。再者，報告產出本身也是一種程式，其煩瑣、惱人也不在話下。但此處工作平台的開發大大降減這些負擔。沒有這一工作平台，這一本研究報告大概也就不可能存在。此工作平台基本上建構在 WinEdt 應用軟體上，主要以其巨集程式語言撰寫爲數眾多的大大小小程式，另外亦加入一些其他語言（如批次檔、Perl 檔、LaTeX檔等）

之大量程式，統合優化各類作業與各式各樣的工作細節，從程式以迄最終報告無不由其完成。對作者而言，這一工作平台的存在與否就象徵科學與非科學，也代表生存抑或消亡。附錄中例示眾多工作平台程式之一例，此程式之功能類似於一鍵「雲端儲存安全備份」，它撰寫於「雲端」觀念幾乎未爲所知的 Windows 2000 年代，是時 SATA 介面尚未導入，而硬碟主流容量尚僅在 40GB。

由於此處所涉細節龐雜瑣碎，程式眾多片斷，謹將一些介面圖形示如圖 9.3 — 9.6。

9.6 Mathematica 程式

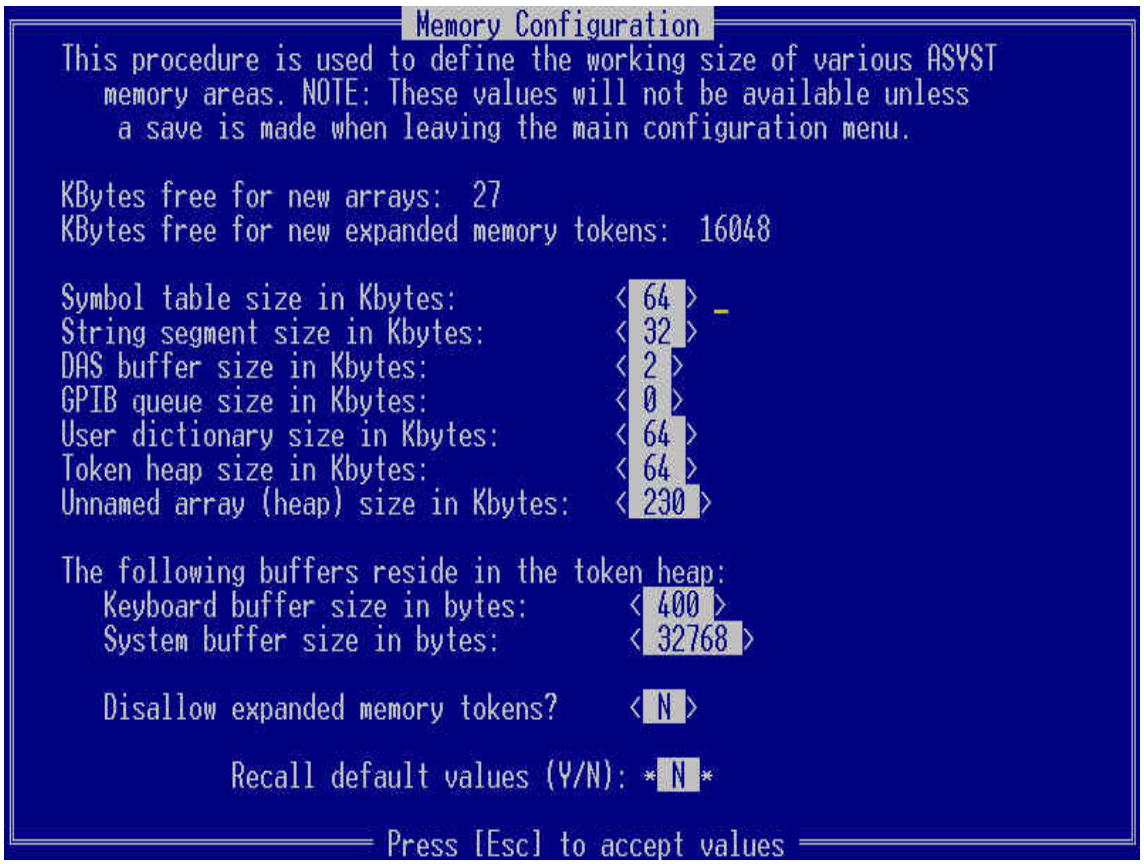
此處之 Mathematica 程式主要是作爲 Asyst 分析數據之後續圖形顯示。Asyst 數據結果一產出即可導入 Mathematica 程式中，不經任何人爲介入，一貫化地繪製二維或三維圖形。這些 Mathematica 程式架構成一套二種類，即外部殼程式與核心主程式，其殼程式充當使用者的直接接觸介面，主要用於圖形顯示參數之設定暨最終顯示，而核心程式是爲殼的內部運作細部，在使用殼程式時載入而使用者不需直接接觸，另於螢幕上亦不出現。此一架構助益於最終結果之精簡、檔案捲動及圖形審視之便利，另外的一個重要好處是避免去誤動到核心程式，而紙本產出時也得節省。此處程式有：

- `TFR-WP_Shell`
- `TFR-WP_Stand-alone`
- `TFR-WV_Shell`
- `TFR-WV_Stand-alone`

9.7 書面制作系統

螢幕上的工作平台固是必須，但在某些方面，紙上作業亦不可或缺。有限的螢幕、捲動式的審視，於眼、於腦往往疲累。此時方便宜人的書面制作系統也關係

研究之成敗。舉其例者如：數據分析或模擬過程中及其結果所產出的圖、表、資料等檔案數量極其龐大，往往一個案例或一組參數就有數十、甚至上百的檔案生成，螢幕的檢視固然是基本，但詳細無誤的診察、分析、比較，基本上是不可行的，此時就必須藉助一個省時省力省事的資料圖檔之紙張出版制作系統。另外程式本身之診誤，若只在螢幕捲動、跳躍式進行，往往陷於以管窺天，治絲益棼，所以其紙張產出也是必須。這也是此處工作平台亦整合了書面制作系統的眾多程式，包含英文系統之中文化功能、一些圖形格式自動化轉換程式、等等。 ❖



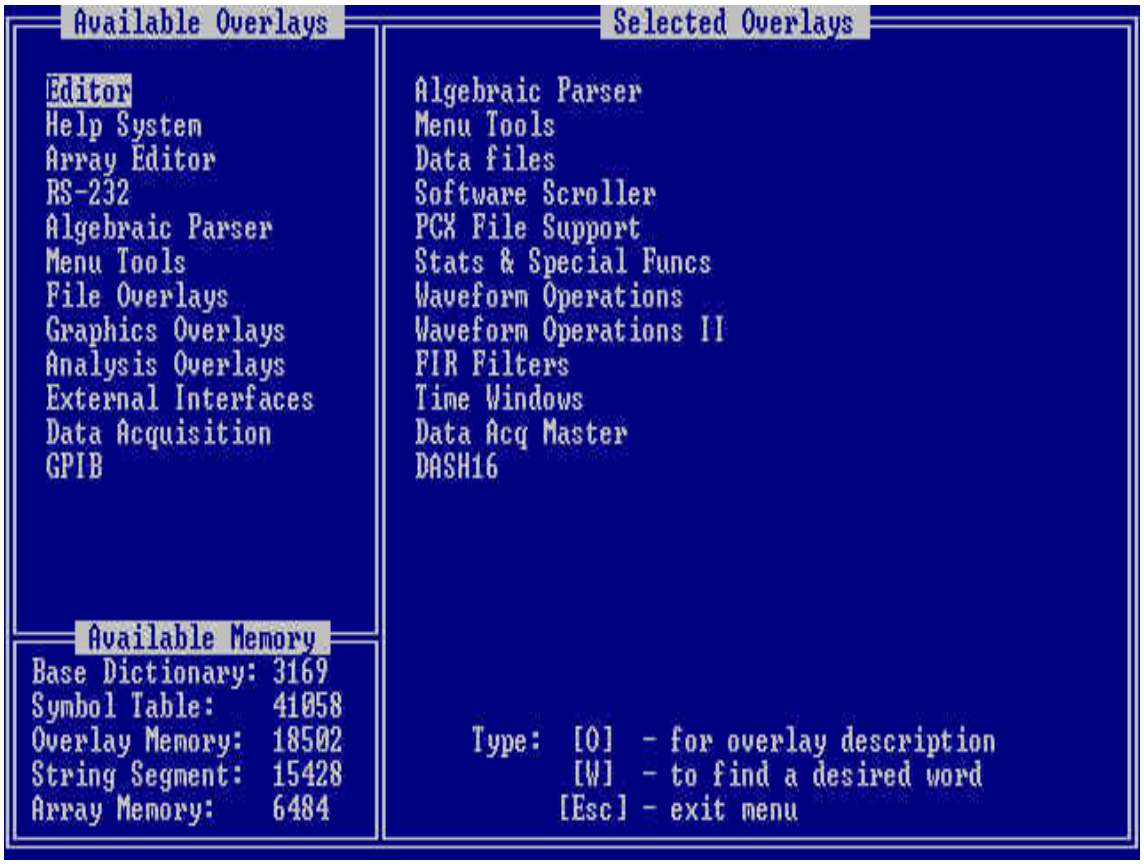
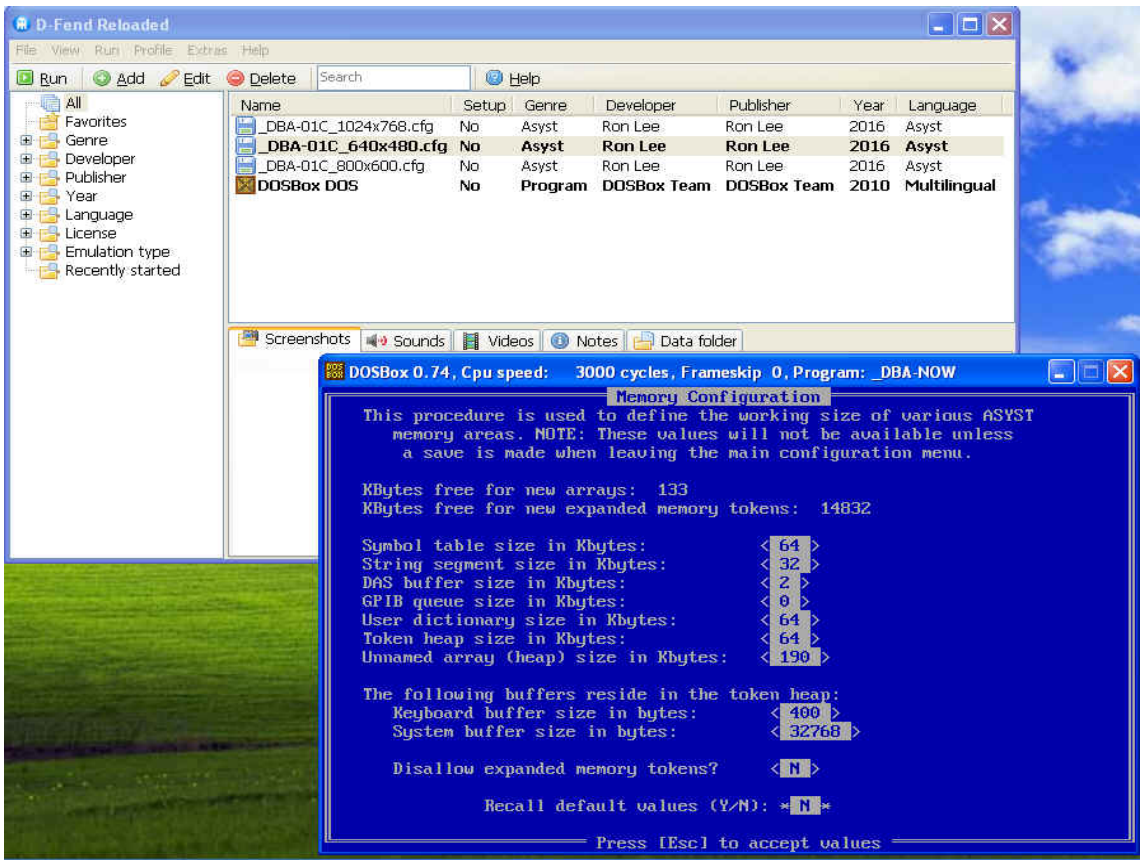


圖 9.1　Asyst 程式之記憶體分配管理與疊置操作程序（Overlay）需求（一）。



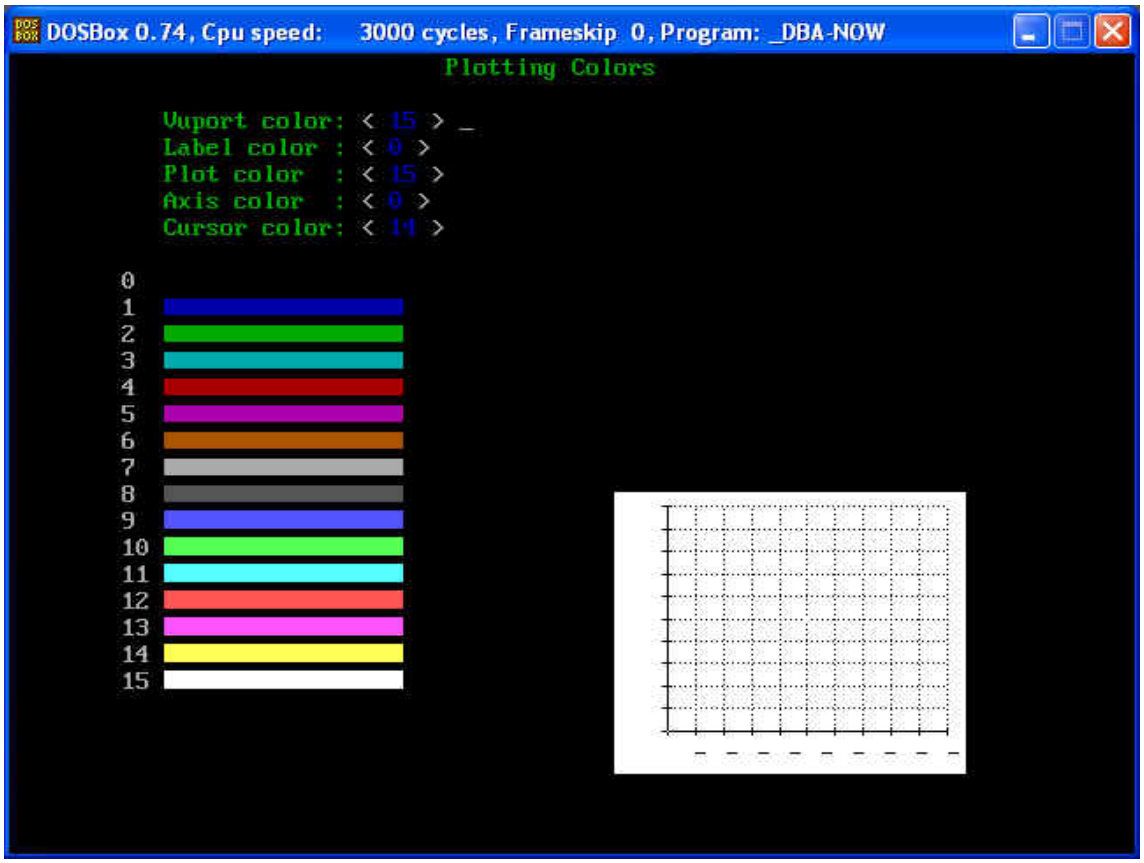


圖 9.2　Asyst 程式之記憶體分配管理與疊置操作程序（Overlay）需求（二）。

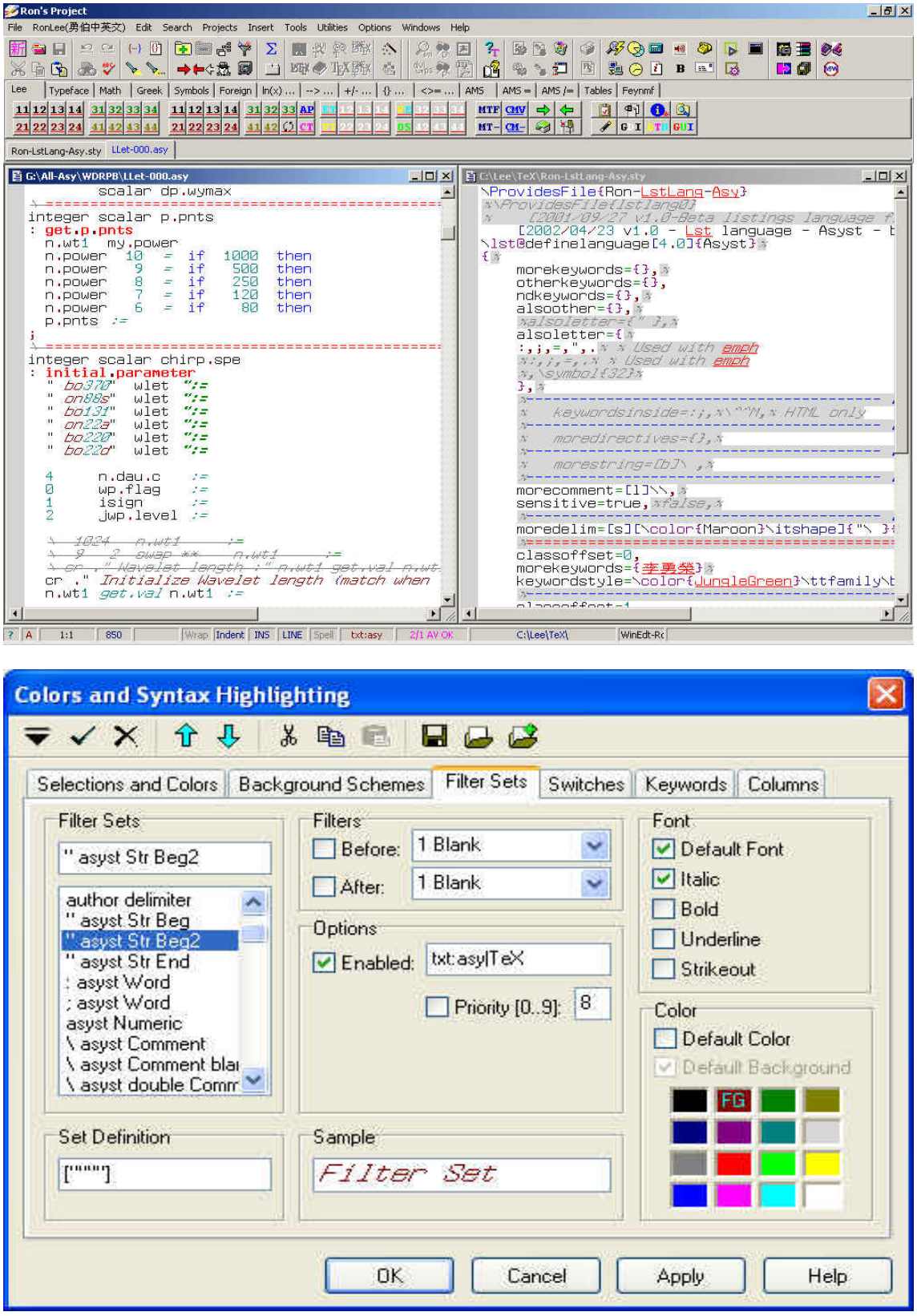


圖 9.3　工作平台介面圖示（syntax scheme）。

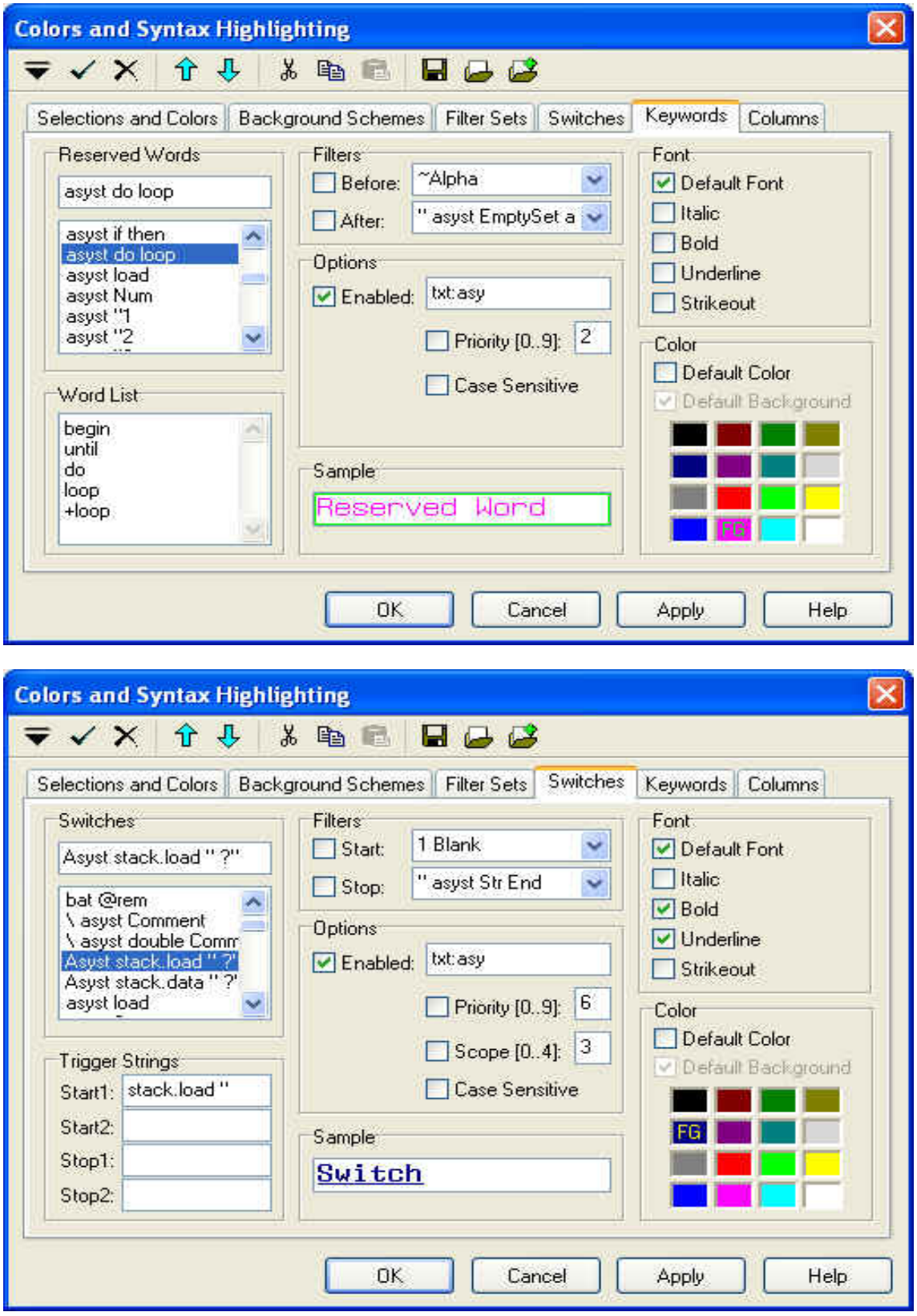


圖 9.4　工作平台介面圖示（Asyst highlighting）。

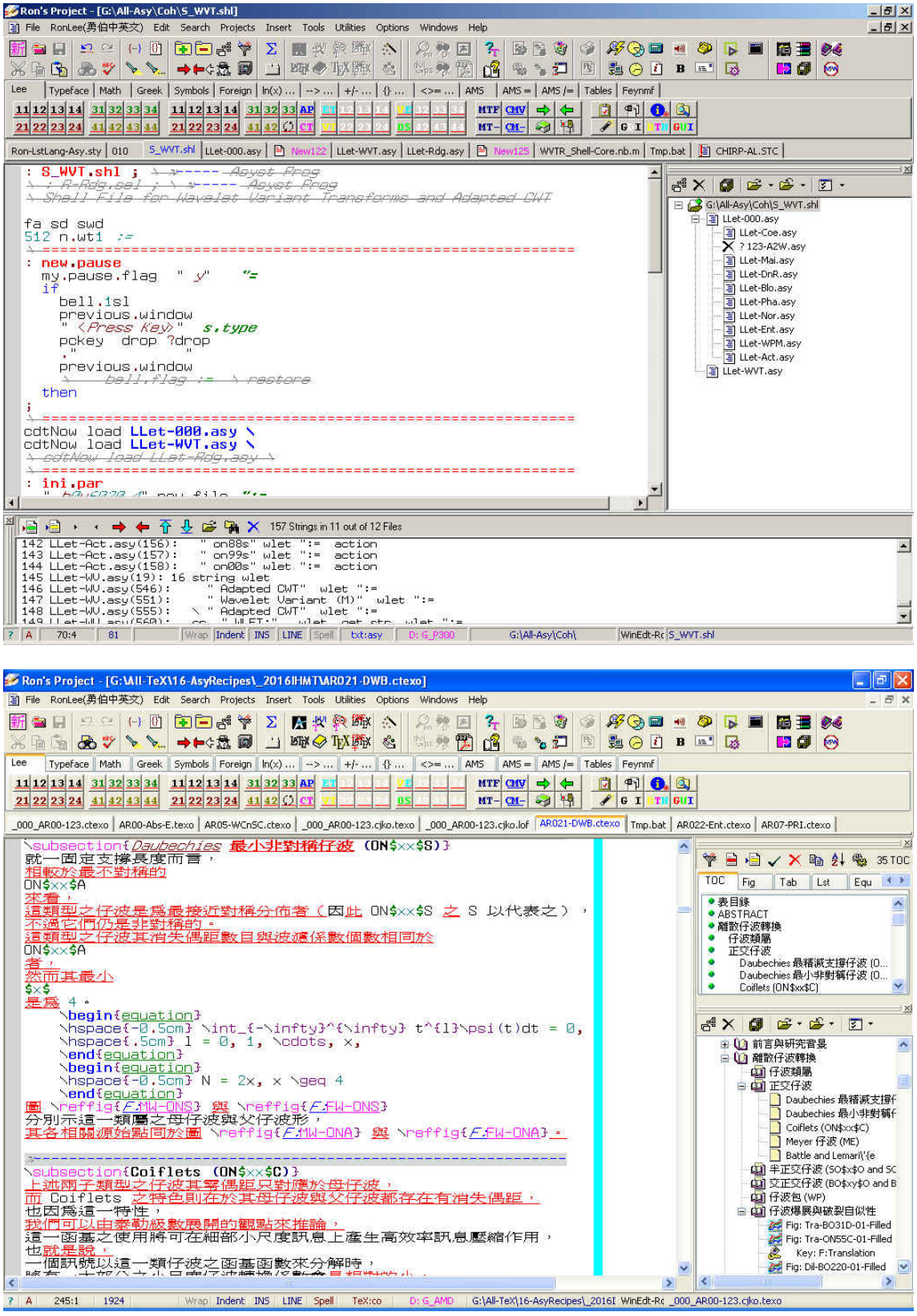


圖 9.5　工作平台介面圖示（program manipulation）。

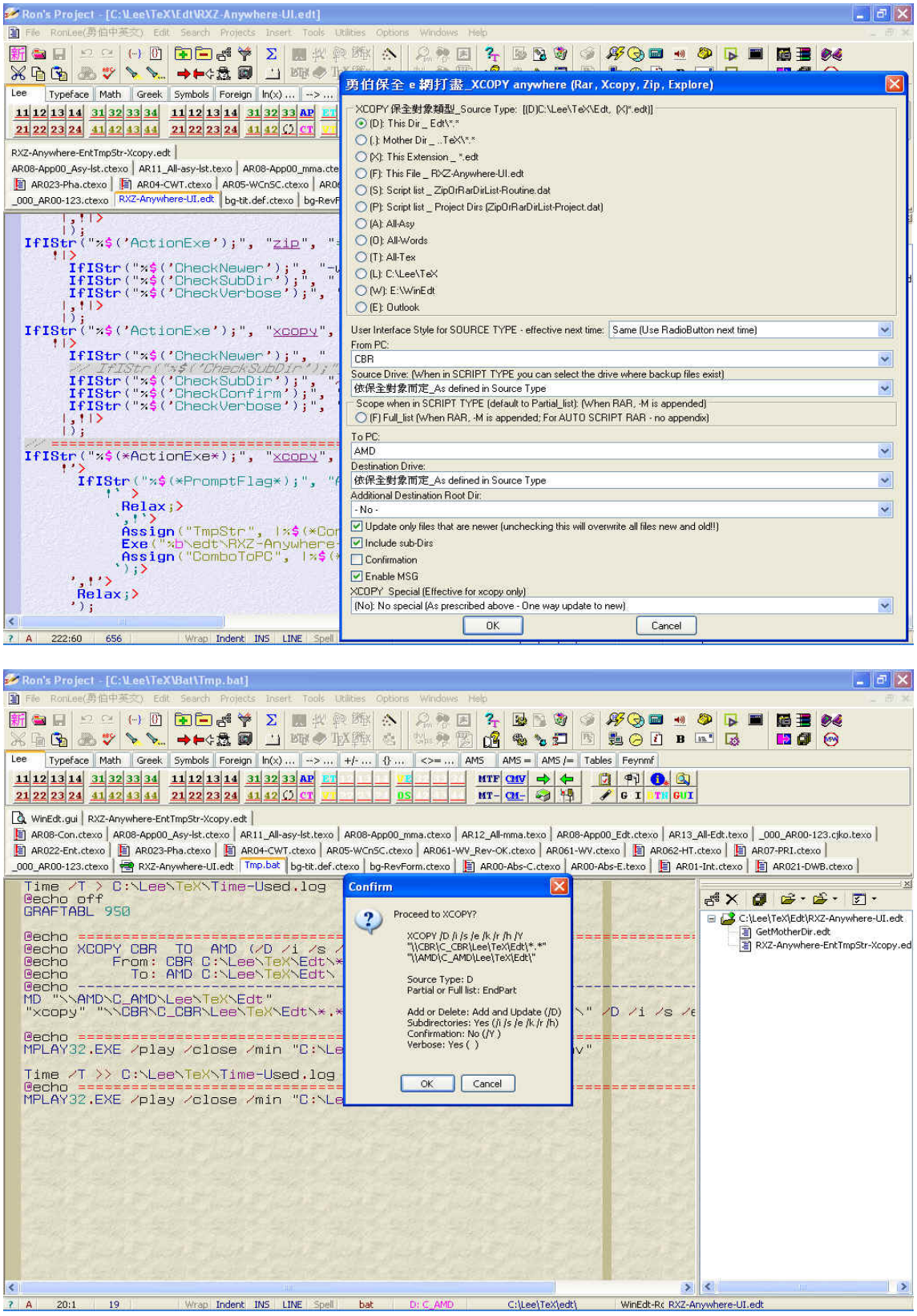


圖 9.6　工作平台介面圖示（cloud backup）。

第 10 章

結論

- 此處整合多年來所撰寫的諸多程式，其分析程式主要使用 Asyst 語言，另這些程式係由數學理論源頭出發，不使用現成套集應用軟件。也由於這一因素，吾人對多年來數據分析結果之掌控、論述、評斷均有其十足信心。而避免指鹿爲馬、顚倒是非是爲研究價值核心。

- 主要訊號分析學理類別有；仔波轉換，希伯轉換，富立葉轉換，越零位統計法，暨相關延伸技法，如類仔波、共關頻振、解析訊號、瞬間頻率、等。此外亦開發試驗室訊號集錄及即時分析與視覺化展示之系統。

- 開發撰寫與整合各類輔助或應用程式碼，建置資料、圖表、文件等之處理、展示、列印、管理系統。除了主要使用 Asyst 語言外，亦使用不少其它程式語言，如； Mathematica 程式，Postfix 程式，WinEdt 巨集程式，LaTeX程式及套件，報表程式介面，外加功能應用等。，

- 一個功能完善、方便使用的整合工作平台亦爲本研究開發工作的核心。缺少這一平台大概也就沒有此處的研究成果。

- 所研究之仔波類屬相當完整，亦有諸多特性探討。包含多類屬之離散仔波、連續仔波與一新型類仔波，相關特性探討，如：正反轉換、爆展、熵值、常標值、最適函基、最適階函基、特性函數相位、共關協振、調適化時頻窗連續仔波轉換、及類仔波設計暨其特性、等。此處得以充分得証下述論點：就

仔波之觀點而言，水波是極其規則而變化簡單之波形，而它的模擬最適仔波函基是一個相對單純、形狀規則的仔波，其是爲半正交之樞點順適仔波，且這一仔波函基在水槽風生水波之模擬表現亦比富立葉函基是來得優越。

- 程式雖也是一種語言，但它的特質是沒有章法與習慣可循，各人說各人的，難以溝通。寫程式的人大都可以體會生命的有限及程式的無止盡，記憶總是那麼短暫，而回顧往往刻骨銘心。檢視修改這些過往程式，作者也經常感到訝異，甚或驚奇，難解當初邏輯思路爲何，嗟歎光陰荏苒，卻也似箭如梭，時不我與。如是之故，程式於他人看來有如天書也就不足爲奇。此處程式碼的結集所希冀的價值核心是：確立研究之可驗証性，追求科學上的客觀嚴謹，庶幾求眞踏實，以盡本責。 ❖

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附錄一：　Asyst 程 式

R_DnR.shl

A01747-20161209-A001 ❖ December 9, 2016 ❖ [Page count: 6]

```
: R_DnR.shl ; \ Wavelet Decomposition and Reconstruction \ -*- txt:asy -*-

fa sd \ swd
1024 n.wt1 :=
cdtNow load LLet-000.asy \

\ ====================================================================
\ --------------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512   n.wt1    :=
  200   s.freq.keep :=          \ Sampling freq -- original rate
  1     i.inc    :=             \ array index Inc for sub-sampling
;
\ --------------------------------------------------------------------
: ini.par.f
  " f0w6020.2" now.file ":=
  1024 n.wt1    :=
  40    s.freq.keep :=          \ Sampling freq -- original rate
  1     i.inc    :=             \ array index Inc for sub-sampling
;
: ini.par.b
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200   s.freq.keep :=          \ Sampling freq -- original rate
  4     i.inc    :=             \ array index Inc for sub-sampling
\   0     abs.flag    :=         \ absolute value norm
\   0     filter.flag :=         \ percentage of norm energy kept
\   0.975 norm.keep.p.best :=    \ for initial filtering
\   6.0   p.b.e :=               \ Pass band end (Hz)
\   6.0   t.w    :=              \ Transition width (Hz)
\   0     best.flag    :=        \ unclear, possibly not necessary (WPM)
\   100   #.div :=               \ foe entropy calculation
;
\ ====================================================================
-1    isign := \ "." <- or -> :"
" D" act.flag.str ":= \ 3     act.flag :=
ini.par.b
\ ini.par.chirp.al
\ ====================================================================
set.act
set.let
set.123
\ for P N E -- set.let and set.123 are Moved into word within set.act
lee
\ --------------------------------------------------------------------
\ \ Keep all default setings for all the above inputs
\ ====================================================================
\ \ ---------------------------------------- ■ \ \ For Blowup
\ \ \ act.all
\ \
```



```
\ \ \ act.all.1 \ LMS
\ \ \ act.all.2 \ ONA
\ \ \ act.all.3 \ ons
\ \ \ act.all.4 \ onc
\ act.all.5 \ bo1
\ \ \ act.all.6 \ bo2
\ \ \ act.all.7 \ bo3
\ \ ====================================================================
\ \ \ Use inverse transform (i.e., <--> -1)
\ \ \ The first i.ele  and jwp.level is for generating wavelet curve
\ \ \ The second i.ele is for blowup
\ \ \ The second jwp.level is for blowup scale (i.e., Eq. to n.power -
  jwp.level)
\ set.let
\ set.123
\ blow
\ ====================================================================
\ --------------------------------------------------------------------
\ ====================================================================
\ ---------------------------------------- ■ \ \ For DnR
\ act.all
\
\ act.all.1 \ LMS
\ act.all.2 \ ONA
\ act.all.3 \ ons
\ act.all.4 \ onc
\ act.all.5 \ bo1
\ act.all.6 \ bo2
\ act.all.7 \ bo3
\ ====================================================================
: ColRowIni
  1  gp.flag  :=
  1  file.no  :=
  \ 1  plot.gp  :=
  plot.gp 1 +  plot.gp  :=
  \
  i.ele  2  jwp.level **  <=
  if
     " Phi-"  PhiPsi.str ":=
  else
     " Psi-"  PhiPsi.str ":=
  then
;
: app.ramp.col
  wlet tmp.s.u ":=
  tmp.s.u "upper "drop
  " $$[("  file.no 0 n>s "cat " ," "cat
  123.ary.n []size swap drop 0 n>s "cat
  \ " ) " "cat tmp.s.u "cat " _" "cat PhiPsi.str "cat " <" "cat
  " ) " "cat PhiPsi.str "cat " <" "cat
  \ ---------------------------------------- ■
  \ \ $$[(5,1034)<1024>]
  \ 123.ary.n []size swap drop 0 n>s
  \ ---------------------------------------- ■
  \ \ $$[(5,1034) Psi-<POL2_BP4,Element:12,Power:10)>]
```

```
  " P" "cat  wp.flag  0 n>s "cat                                          106
  " L" jwp.level 0 n>s "cat
  " _BP" "cat 2 jwp.level ** 0 n>s "cat
  \ " ,Power:" "cat n.power 0 n>s "cat
  " ,Ori" "cat i.ele 0 n>s "cat
  " ,Pw" "cat n.power 0 n>s "cat                                          111
  \ ---------------------------------------- ■
  "cat
  " >]" "cat
  123.ary.s "[ 1 ] ":=
  \                                                                       116
  123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n
  \
  to.123
  file.no 1 + file.no := \ post inc of column
;                                                                         121

\ ---------------------------------------- ■
\ \ Use act.all...  (Large wks array)
\ 0 plot.gp  :=
\ ColRowIni  " psi-LMS.wks"   " 000.wks"  set.123.BP   act.all.1 \ LMS    126
\ ColRowIni  " psi-ONA.wks"   " 000.wks"  set.123.BP   act.all.2 \ ONA
\ ColRowIni  " psi-ONS.wks"   " 000.wks"  set.123.BP   act.all.3 \ ONS
\ ColRowIni  " psi-ONC.wks"   " 000.wks"  set.123.BP   act.all.4 \ ONC
\ ColRowIni  " psi-BO1.wks"   " 000.wks"  set.123.BP   act.all.5 \ BO1
\ ColRowIni  " psi-BO2.wks"   " 000.wks"  set.123.BP   act.all.6 \ BO2    131
\ ColRowIni  " psi-BO3.wks"   " 000.wks"  set.123.BP   act.all.7 \ BO3
\ ----------------------------------------------------------------
\ \ Use act.Gp...  (small and refined wks array for figure plotting)
ACT.Gp.Ini
ColRowIni PhiPsi.str " LMS.wks"  "cat " 0.0" set.123.BP act.Gp.LMS      136
   app.ramp.col
ColRowIni PhiPsi.str " ONC.wks"  "cat " 0.0" set.123.BP act.Gp.onC
   app.ramp.col
ColRowIni PhiPsi.str " ONA1.wks" "cat " 0.0" set.123.BP act.Gp.onA1
   app.ramp.col
ColRowIni PhiPsi.str " ONA2.wks" "cat " 0.0" set.123.BP act.Gp.onA2
   app.ramp.col
ColRowIni PhiPsi.str " ONS1.wks" "cat " 0.0" set.123.BP act.Gp.onS1
   app.ramp.col
ColRowIni PhiPsi.str " ONS2.wks" "cat " 0.0" set.123.BP act.Gp.onS2      141
   app.ramp.col
ColRowIni PhiPsi.str " BO10.wks" "cat " 0.0" set.123.BP act.Gp.bo10
   app.ramp.col
ColRowIni PhiPsi.str " BO1D.wks" "cat " 0.0" set.123.BP act.Gp.bo1D
   app.ramp.col
ColRowIni PhiPsi.str " BO20.wks" "cat " 0.0" set.123.BP act.Gp.bo20
   app.ramp.col
ColRowIni PhiPsi.str " BO2D.wks" "cat " 0.0" set.123.BP act.Gp.bo2D
   app.ramp.col
ColRowIni PhiPsi.str " BO30.wks" "cat " 0.0" set.123.BP act.Gp.bo30      146
   app.ramp.col
ColRowIni PhiPsi.str " BO3D.wks" "cat " 0.0" set.123.BP act.Gp.bo3D
   app.ramp.col
\ \ ----------------------------------------------------------------
```



```
\ \ : Plt.shl
\ \   PhiPsi.str "upper " PHI" "=
\ \   if                                                                151
\ \     cdtNow load Plt_FW.shl \
\ \   then
\ \   PhiPsi.str "upper " PSI" "=
\ \   if
\ \     cdtNow load Plt_MW.shl \                                        156
\ \   then
\ \ ;
\ \ \ Plt.shl \ \ load execution depth exceeded
\ \ ================================================================
\ \ ----------------------------------------------------------------  161
\ \ ================================================================
\ PhiPsi.str tmp.s ":=
\ fa
\ 4 string PhiPsi.str
\ tmp.s PhiPsi.str ":=                                                166
\ \ ================================================================
\ cdt load FigA-Ini.asy \
\ 2.0 ps.linewidth.now :=
\ \ ================================================================
\ : file.name                                                         171
\   stack.data tmp.s " LMS.WKS" "cat
\   stack.load " MnF-LMS.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name                                                    176
\
\ : file.name
\   stack.data PhiPsi.str " LMS.WKS" "cat
\   stack.load " MnF-LMS.BPF"
\ ;                                                                   181
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONC.WKS" "cat                             186
\   stack.load " MnF-ONC.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\                                                                     191
\ : file.name
\   stack.data PhiPsi.str " ONA1.WKS" "cat
\   stack.load " MnF-ONA1.BPF"
\ ;
\ cdt load FigACore.asy \                                             196
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONA2.WKS" "cat
\   stack.load " MnF-ONA2.BPF"                                        201
\ ;
\ cdt load FigACore.asy \
```

```
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONS1.WKS" "cat
\   stack.load " MnF-ONS1.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONS2.WKS" "cat
\   stack.load " MnF-ONS2.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO1O.WKS" "cat
\   stack.load " MnF-BO1O.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO1D.WKS" "cat
\   stack.load " MnF-BO1D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO2O.WKS" "cat
\   stack.load " MnF-BO2O.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO2D.WKS" "cat
\   stack.load " MnF-BO2D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO3O.WKS" "cat
\   stack.load " MnF-BO3O.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO3D.WKS" "cat
\   stack.load " MnF-BO3D.BPF"
\ ;
```



```
\ cdt load FigACore.asy \
\ forget file.name
\ \ ================================================================
```

R_TnD.shl

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```
: R_TnD.shl ; \ Wavelet translation and Dilation \ -*- txt:asy -*-

fa sd \ swd
\ 1024 n.wt1 := \ \ Use ini.par.f
512 n.wt1 :=  \ \ Use ini.par.chirp.al
cdtNow load LLet-000.asy \

\ ====================================================================
\ --------------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512  n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
;
\ --------------------------------------------------------------------
: ini.par.f
  " f0w6020.2" now.file ":=
  1024 n.wt1    :=
  40   s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
;
: ini.par.b
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  4    i.inc    :=             \ array index Inc for sub-sampling
\   0    abs.flag    :=         \ absolute value norm
\   0    filter.flag :=         \ percentage of norm energy kept
\   0.975 norm.keep.p.best :=   \ for initial filtering
\   6.0  p.b.e :=               \ Pass band end (Hz)
\   6.0  t.w   :=               \ Transition width (Hz)
\   0    best.flag   :=         \ unclear, possibly not necessary (WPM)
\   100  #.div :=               \ foe entropy calculation
;
\ ====================================================================
-1   isign := \ ." <- or -> :"
" D" act.flag.str ":= \ 3    act.flag :=
\ ini.par.b
ini.par.chirp.al
\ ====================================================================
set.act
set.let
set.123
\ for P N E -- set.let and set.123 are Moved into word within set.act
lee
\ --------------------------------------------------------------------
\ \ Keep all default setings for all the above inputs
\ ====================================================================
\ ---------------------------------------- ■ \ \ For Blowup
\ act.all
\
```



```
\ act.all.1 \ LMS
\ act.all.2 \ ONA
\ act.all.3 \ ons
\ act.all.4 \ onc
\ act.all.5 \ bo1
\ act.all.6 \ bo2
\ act.all.7 \ bo3
\ ====================================================================
\ \ Use inverse transform (i.e., <--> -1)
\ \ The first i.ele  and jwp.level is for generating wavelet curve
\ \ The second i.ele is for blowup
\ \ The second jwp.level is for blowup scale (i.e., Eq. to n.power -
   jwp.level)
\ set.let
\ set.123
\ blow
\ ====================================================================
\ --------------------------------------------------------------------
\ ====================================================================

\ ====================================================================
: ColRowIni
  1  gp.flag  :=
  1  file.no  :=
  \ 1  plot.gp  :=
  plot.gp 1 +  plot.gp  :=
  \
  i.ele  2  jwp.level **  <=
  if
     " Phi-"  PhiPsi.str ":=
  else
     " Psi-"  PhiPsi.str ":=
  then
;
\ : rename.wks \ [ "str - ]
\   cdanow
\   123.file.name defer> rename \ copy
\   tmp.s.u  "cat " .wks" "cat
\   "dup
\   defer> to
\   defer> delete
\ ;
: rename.wks \ [ "str - ]
  cdanow
  123.file.name defer> copy
  tmp.s.u  "cat " .wks" "cat
  defer> to
  123.file.name defer> delete
;
: copy.wks \ [ "str - ]
  cdanow
  123.file.name defer> copy
  tmp.s.u  "cat " .wks" "cat
  defer> to
\ cdanow
```

```
\ 123.file.name defer> copy
\ " 000.wks" defer> to
;
8 string copy.type
: app.wks.col                                                          111
  " $$[(" file.no 0 n>s "cat " ," "cat
  123.ary.n []size swap drop 0 n>s "cat
  " ) " "cat
  tmp.s.u  "cat
\   " -P" "cat                                                         116
\   wp.flag  0 n>s "cat
\   " L" "cat jwp.level 0 n>s "cat
  " ]" "cat
  123.ary.s "[ 1 ] ":=
  123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n        121
  \
  to.123
  file.no 1 + file.no := \ post inc of column
  \ ---------------------------------------- ■
  copy.type                                                            126
  rename.wks \ copy.wks
;

: to.wks
  " Ori" i.ele 0 n>s "cat                                              131
  " -P" "cat wp.flag  0 n>s "cat
  " L" "cat jwp.level 0 n>s "cat
  " _BP"  "cat 2 jwp.level 1 + ** 0 n>s "cat
  123.ary.s "[ 1 ] ":=
  swt.t becomes> 123.ary.n                                             136
  to.123
  cr cr ." Column.#"  file.no n.type
  file.no 1 + file.no :=
;
\ ================================================================     141
: lee.auto
  isign  -1  =
  if
    n.wt1  dp.real ramp  becomes> b
    1  0 fix.format                                                    146
    0.  b  :=
    \ cr ." JWP Level(" wlet s.type ." ):"  jwp.level  get.val
       jwp.level :=
\ ----------------------------------------------------------------
    cr ." Element "
    wp.flag 1 =                                                        151
    if
      " (WP: located at level "  jwp.level 0 n>s "cat " )" "cat s.type.3
    else
      " (WB: min. level at "  jwp.level 0 n>s "cat " )" "cat s.type.3
    then                                                               156
    ." (Phi<-"
    1  0 fix.format
    jwp.level  9 >=
    if                          4
```



```
    else                                                               161
      jwp.level  6 >=
      if                        3
      else
        jwp.level  3 >=
        if                      2                                      166
        else                    1
        then
      then
    then
    dup  num.dig :=    0  fix.format                                   171
    2 jwp.level     ** n.type ." |->Psi:[WB"
    \ ---------------------------------------- ■
    wp.flag 1 =
    if
      ." <-"                                                           176
      1  0 fix.format
      jwp.level  9 >=
      if                            4
      else
        jwp.level  6 >=                                                181
        if                          3
        else
          jwp.level  3 >=
          if                        2
          else                      1                                  186
          then
        then
      then
      dup  num.dig :=    0  fix.format
      2 jwp.level 1 + ** n.type ." |->WP]): "                          191
    else
      ." ]): "
    then
\ ----------------------------------------------------------------
\     cr ." Element (WB<-"                                             196
\     1  0 fix.format
\     jwp.level  9 >=
\     if                          4
\     else
\       jwp.level  6 >=                                                201
\       if                        3
\       else
\         jwp.level  3 >=
\         if                      2
\         else                    1                                    206
\         then
\       then
\     then
\     dup  num.dig :=    0  fix.format
\     2 jwp.level 1 + ** n.type ." |->WP):"                            211
    3 0 fix.format
    \ i.ele get.val i.ele :=
    1 0 fix.format
    \ cr ." Clear (1) or Overlap:"     i.lin      get.val    i.lin     :=
```

```
    1.  b [ i.ele ] :=                                                  216
    b  inverse.wt
    wp.flag 1 =
    if
      drop  swp.t
    else                                                                221
      drop  swt.t
    then
  else
    {hp.wnd}  " Have you set B (in --> mode)?" s.type  \ my.pause
    cr ." Choose array for Forward Transform "                          226
    " 0:default B, 1:WB.t, 2:WP.t" s.type.3
    0 get.val
    case
      1  of   swt.t  endof
      2  of   swp.t  endof                                             231
      0  of   b      endof
    endcase
    previous.window
    forward.wt      \ always d.t for WB and WP -- set Wp.flag
  then                                                                  236
  n.power  10 = if  sub[ 1 , 1000 ] then
  n.power   9 = if  sub[ 1 ,  500 ] then
  n.power   8 = if  sub[ 1 ,  250 ] then
  n.power   7 = if  sub[ 1 ,  120 ] then
  n.power   6 = if  sub[ 1 ,   70 ] then                                241
  i.lin
  i.lin     1 =
  if  yap   lab.spe   else  ydp  then
  10 5 fix.format
;                                                                       246
\ ----------------------------------------------------------------------
\ : lee.auto \ no pause for input
\   isign  -1  =
\   if
\     n.wt1  dp.real ramp  becomes> b                                   251
\     1  0 fix.format
\     0.  b  :=
\     \ \ Auto \  cr ." JWP Level(" wlet s.type ." ):"  jwp.level
   get.val   jwp.level :=
\     cr ." Element (WB--"
\     1  0 fix.format                                                   256
\     jwp.level  9 >=
\     if                        4
\     else
\       jwp.level  6 >=
\       if                      3                                     261
\       else
\         jwp.level  3 >=
\         if                    2
\         else                  1
\         then                                                        266
\       then
\     then
\     dup  num.dig :=    0  fix.format
```



```
\     2 jwp.level 1 + ** n.type ." --WP):"
\     3 0 fix.format                                                    271
\     \ \ Auto \  i.ele get.val i.ele :=    1 0 fix.format
\     \ \ Auto \  cr ." Clear (1) or Overlap:"     i.lin      get.val
   i.lin     :=
\     1.  b [ i.ele ] :=
\     b  inverse.wt
\     wp.flag 1 =                                                       276
\     if
\       drop  swp.t
\     else
\       drop  swt.t
\     then                                                              281
\   else
\     {hp.wnd}  " Have you set B (in --> mode)?" s.type  my.pause
\     \ \ Auto \  cr ." Choose  1:WB.t,  2:WP.t,  0:default B"  0
   get.val
\     0 \ \ Auto added\
\     case                                                              286
\       1  of   swt.t  endof
\       2  of   swp.t  endof
\       0  of   b      endof
\     endcase
\     previous.window                                                   291
\     forward.wt      \ always d.t for WB and WP -- set Wp.flag
\   then
\   n.power  10 = if  sub[ 1 , 1000 ] then
\   n.power   9 = if  sub[ 1 ,  500 ] then
\   n.power   8 = if  sub[ 1 ,  250 ] then                            296
\   n.power   7 = if  sub[ 1 ,  120 ] then
\   n.power   6 = if  sub[ 1 ,   70 ] then
\   i.lin
\   i.lin     1 =
\   if  yap   lab.spe   else  ydp  then                               301
\   10 5 fix.format
\ ;
\ ================================================================
\ ================================================================
: scale.012                                                           306
" Dil" copy.type ":="
0   jwp.level :=
3   i.ele     :=
lee.auto
to.wks                                                                311

1   jwp.level :=
6   i.ele     :=
lee.auto
to.wks                                                                316

2   jwp.level :=
12  i.ele     :=
lee.auto
to.wks                                                                321
```

```
3   jwp.level :=
20  i.ele     :=
lee.auto
to.wks                                                          326

4   jwp.level :=
54  i.ele     :=
lee.auto
to.wks                                                          331

5   jwp.level :=
74  i.ele     :=
lee.auto
to.wks                                                          336

6   jwp.level :=
200 i.ele     :=
lee.auto
to.wks                                                          341

7   jwp.level :=
450 i.ele     :=
lee.auto
to.wks                                                          346
;
\ ------------------------------------------------------------------
: position.012
" Tra" copy.type ":=
3   jwp.level :=                                                351
16  i.ele     :=
lee.auto
to.wks

3   jwp.level :=                                                356
20  i.ele     :=
lee.auto
to.wks

3   jwp.level :=                                                361
24  i.ele     :=
lee.auto
to.wks

3   jwp.level :=                                                366
28  i.ele     :=
lee.auto
to.wks

3   jwp.level :=                                                371
32  i.ele     :=
lee.auto
to.wks
;
\ ==================================================================  376
\ ==================================================================
```



```
" bo220" wlet ":=
0 jwp.level :=
ColRowIni
1 file.no :=                                                    381
set.let
set.123
\ ---------------------------------------- -
scale.012
wlet tmp.s.u ":=                                                386
tmp.s.u "upper "drop
app.wks.col
\ ==================================================================
" bo22d" wlet ":=
0 jwp.level :=                                                  391
ColRowIni
1 file.no :=
set.let
set.123
\ ---------------------------------------- -                    396
scale.012
wlet tmp.s.u ":=
tmp.s.u "upper "drop
app.wks.col
\ ==================================================================  401
" bo31d" wlet ":=
0 jwp.level :=
ColRowIni
1 file.no :=
set.let                                                         406
set.123
\ ---------------------------------------- -
scale.012
wlet tmp.s.u ":=
tmp.s.u "upper "drop                                            411
app.wks.col
\ ==================================================================
" bo370" wlet ":=
0 jwp.level :=
ColRowIni                                                       416
1 file.no :=
set.let
set.123
\ ---------------------------------------- -
scale.012                                                       421
wlet tmp.s.u ":=
tmp.s.u "upper "drop
app.wks.col
\ ==================================================================
" on66a" wlet ":=                                               426
0 jwp.level :=
ColRowIni
1 file.no :=
set.let
set.123                                                         431
\ ---------------------------------------- -
```

```
scale.012
wlet tmp.s.u ":=
tmp.s.u "upper "drop
app.wks.col                                                          436
\ ------------------------------------------------------------------
\ ------------------------------------------------------------------
\ ------------------------------------------------------------------
" bo31d" wlet ":=
0   jwp.level :=                                                     441
ColRowIni
1 file.no :=
set.let
set.123
\ ---------------------------------------- -                         446
position.012
wlet tmp.s.u ":=
tmp.s.u "upper "drop
app.wks.col
\ ------------------------------------------------------------------ 451
" on55c" wlet ":=
0   jwp.level :=
ColRowIni
1 file.no :=
set.let                                                              456
set.123
\ ---------------------------------------- -
position.012
wlet tmp.s.u ":=
tmp.s.u "upper "drop                                                 461
app.wks.col
\ ------------------------------------------------------------------
```

R_Blo.shl

A01749-20161209-A003 ❖ December 9, 2016 ❖ [Page count: 6]

```
: R-Blo.shl ; \ Blowups of wavelet bases and packets  \ -*- txt:asy -*-
fa sd \ swd

\ 1024 n.wt1 := \ \ Use ini.par.f
512 n.wt1 :=  \ \ Use ini.par.chirp.al

\ ================================================================
\ ----------------------------------------------------------------
cdtNow load LLet-000.asy \
\ ================================================================
\ ----------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512  n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
;
\ ----------------------------------------------------------------
: ini.par.f
  " f0w6020.2" now.file ":=
  1024 n.wt1    :=
  40   s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
;
: ini.par.b
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  4    i.inc    :=             \ array index Inc for sub-sampling
\   0    abs.flag    :=         \ absolute value norm
\   0    filter.flag :=         \ percentage of norm energy kept
\   0.975 norm.keep.p.best :=   \ for initial filtering
\   6.0  p.b.e :=               \ Pass band end (Hz)
\   6.0  t.w   :=               \ Transition width (Hz)
\   0    best.flag   :=         \ unclear, possibly not necessary (WPM)
\   100  #.div :=               \ foe entropy calculation
;
\ ================================================================
-1   isign := \ ." <- or -> :"
" D" act.flag.str ":= \ 3    act.flag :=
\ ini.par.b \ \ For 1024
ini.par.chirp.al \ \ For 512
\ \ ============================================================
\ set.act
\ set.let
\ set.123
\ \ for P N E -- set.let and set.123 are Moved into word within set.act
\ lee
\ \ \ act.all
\ \ \ ============================================================
\ \
```



```
\ \ \ act.all.1 \ LMS
\ \ \ act.all.2 \ ONA
\ \ \ act.all.3 \ ons
\ \ \ act.all.4 \ onc
\ act.all.5 \ bo1
\ \ \ act.all.6 \ bo2
\ \ \ act.all.7 \ bo3
\ \ \ ============================================================
\ ================================================================
set.act
set.let
set.123
\ for P N E -- set.let and set.123 are Moved into word within set.act
lee
\ ----------------------------------------------------------------
blow
\ ----------------------------------------------------------------
\ \ Keep all default setings for all the above inputs
\ \ ============================================================
\ ---------------------------------------- ■ \ \ For Blowup
\ \ act.all
\
\ \ act.all.1 \ LMS
\ \ act.all.2 \ ONA
\ \ act.all.3 \ ons
\ \ act.all.4 \ onc
\ \ act.all.5 \ bo1
\ \ act.all.6 \ bo2
\ \ act.all.7 \ bo3
\ \ ============================================================
\ \ Use inverse transform (i.e., <--> -1)
\ \ The first i.ele  and jwp.level is for generating wavelet curve
\ \ The second i.ele is for blowup
\ \ The second jwp.level is for blowup scale (i.e., Eq. to n.power -
   jwp.level)
\ set.let
\ set.123
\ blow
\ ============================================================
\ ------------------------------------------------------------
\ ============================================================
\ ---------------------------------------- ■ \ \ For DnR
\ : ColRowIni
\   1  gp.flag  :=
\   1  file.no  :=
\   \ 1  plot.gp  :=
\   plot.gp 1 +  plot.gp  :=
\   \
\   i.ele  2  jwp.level **  <=
\   if
\      " PHI-"  PhiPsi.str ":=
\   else
\      " PSI-"  PhiPsi.str ":=
\   then
\ ;
```

```
\ : app.ramp.col
\   " $$[("  file.no 0 n>s "cat " ," "cat
\   123.ary.n []size swap drop 0 n>s "cat
\   " ) " "cat PhiPsi.str "cat " <" "cat
\   \ ---------------------------------------- ■
\   \ \ $$[(5,1034)<1024>]
\   \ 123.ary.n []size swap drop 0 n>s
\   \ ---------------------------------------- ■
\   \ \ $$[(5,1034) Psi-<Level:2_Pt4,Power:10,Element:12)>]
\   " Level:" jwp.level 0 n>s "cat
\   " _Pt" "cat 2 jwp.level ** 0 n>s "cat
\   \ " ,Power:" "cat n.power 0 n>s "cat
\   " ,Pw" "cat n.power 0 n>s "cat
\   " ,Element:" "cat i.ele 0 n>s "cat
\   \ ---------------------------------------- ■
\   "cat
\   " >]" "cat
\   123.ary.s "[ 1 ] ":=
\   \
\   123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n
\   \
\   to.123
\   file.no 1 + file.no := \ post inc of column
\ ;
\
\ \ ---------------------------------------- ■
\ \ 0 plot.gp  :=
\ \ ColRowIni  " psi-LMS.wks"   " 000.wks"  set.123.BP   act.all.1 \ LMS
\ \ ColRowIni  " psi-ONA.wks"   " 000.wks"  set.123.BP   act.all.2 \ ONA
\ \ ColRowIni  " psi-ONS.wks"   " 000.wks"  set.123.BP   act.all.3 \ ONS
\ \ ColRowIni  " psi-ONC.wks"   " 000.wks"  set.123.BP   act.all.4 \ ONC
\ \ ColRowIni  " psi-BO1.wks"   " 000.wks"  set.123.BP   act.all.5 \ BO1
\ \ ColRowIni  " psi-BO2.wks"   " 000.wks"  set.123.BP   act.all.6 \ BO2
\ \ ColRowIni  " psi-BO3.wks"   " 000.wks"  set.123.BP   act.all.7 \ BO3
\ \ ------------------------------------------------------------------
\ ACT.Gp.Ini
\ ColRowIni PhiPsi.str " LMS.wks"  "cat " 0.0" set.123.BP act.Gp.LMS
   app.ramp.col
\ ColRowIni PhiPsi.str " ONC.wks"  "cat " 0.0" set.123.BP act.Gp.onC
   app.ramp.col
\ ColRowIni PhiPsi.str " ONA1.wks" "cat " 0.0" set.123.BP act.Gp.onA1
   app.ramp.col
\ ColRowIni PhiPsi.str " ONA2.wks" "cat " 0.0" set.123.BP act.Gp.onA2
   app.ramp.col
\ ColRowIni PhiPsi.str " ONS1.wks" "cat " 0.0" set.123.BP act.Gp.onS1
   app.ramp.col
\ ColRowIni PhiPsi.str " ONS2.wks" "cat " 0.0" set.123.BP act.Gp.onS2
   app.ramp.col
\ ColRowIni PhiPsi.str " BO1O.wks" "cat " 0.0" set.123.BP act.Gp.bo10
   app.ramp.col
\ ColRowIni PhiPsi.str " BO1D.wks" "cat " 0.0" set.123.BP act.Gp.bo1D
   app.ramp.col
\ ColRowIni PhiPsi.str " BO2O.wks" "cat " 0.0" set.123.BP act.Gp.bo20
   app.ramp.col
\ ColRowIni PhiPsi.str " BO2D.wks" "cat " 0.0" set.123.BP act.Gp.bo2D
```



```
   app.ramp.col
\ ColRowIni PhiPsi.str " BO3O.wks" "cat " 0.0" set.123.BP act.Gp.bo30
   app.ramp.col
\ ColRowIni PhiPsi.str " BO3D.wks" "cat " 0.0" set.123.BP act.Gp.bo3D
   app.ramp.col
\
\ \ : Plt.shl
\ \   PhiPsi.str "upper " PHI" "=
\ \   if
\ \     cdtNow load Plt_FW.shl \
\ \   then
\ \   PhiPsi.str "upper " PSI" "=
\ \   if
\ \     cdtNow load Plt_MW.shl \
\ \   then
\ \ ;
\ \ \ Plt.shl \ \ load execution depth exceeded
\
\ \ ================================================================
\ \ ----------------------------------------------------------------
\ \ ================================================================
\ PhiPsi.str tmp.s ":=
\ fa
\ 4 string PhiPsi.str
\ tmp.s PhiPsi.str ":=
\ \ ================================================================
\ cdt load FigA-Ini.asy \
\ 2.0 ps.linewidth.now :=
\ \ ================================================================
\ : file.name
\   stack.data tmp.s " LMS.WKS" "cat
\   stack.load " MnF-LMS.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " LMS.WKS" "cat
\   stack.load " MnF-LMS.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONC.WKS" "cat
\   stack.load " MnF-ONC.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONA1.WKS" "cat
\   stack.load " MnF-ONA1.BPF"
\ ;
\ cdt load FigACore.asy \
```

```
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONA2.WKS" "cat
\   stack.load " MnF-ONA2.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONS1.WKS" "cat
\   stack.load " MnF-ONS1.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " ONS2.WKS" "cat
\   stack.load " MnF-ONS2.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO10.WKS" "cat
\   stack.load " MnF-BO10.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO1D.WKS" "cat
\   stack.load " MnF-BO1D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO20.WKS" "cat
\   stack.load " MnF-BO20.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO2D.WKS" "cat
\   stack.load " MnF-BO2D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO30.WKS" "cat
\   stack.load " MnF-BO30.BPF"
\ ;
```



```
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data PhiPsi.str " BO3D.WKS" "cat
\   stack.load " MnF-BO3D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\ \ ================================================================
```

R_Lev.shl

A01750-20161209-A004 ❖ December 9, 2016 ❖ [Page count: 7]

```
: R-Lev.shl ; \ Show WB and WP at various levels/points \ -*- txt:asy -*-

fa sd \ swd

\ 1024 n.wt1 := \ \ Use ini.par.f
512 n.wt1 :=  \ \ Use ini.par.chirp.al
cdtNow load LLet-000.asy \

\ ================================================================
\ ----------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512  n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
;
\ ----------------------------------------------------------------
: ini.par.f
  " f0w6020.2" now.file ":=
  1024 n.wt1    :=
  40   s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
;
: ini.par.b
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  4    i.inc    :=             \ array index Inc for sub-sampling
\   0     abs.flag    :=        \ absolute value norm
\   0     filter.flag :=        \ percentage of norm energy kept
\   0.975 norm.keep.p.best :=   \ for initial filtering
\   6.0   p.b.e :=              \ Pass band end (Hz)
\   6.0   t.w   :=              \ Transition width (Hz)
\   0     best.flag   :=        \ unclear, possibly not necessary (WPM)
\   100   #.div :=              \ foe entropy calculation
;
\ ================================================================
-1   isign := \ ." <- or -> :"
" D" act.flag.str ":= \ 3    act.flag :=
\ ini.par.b
ini.par.chirp.al
\ ================================================================
cdtNow load LLet-Lev.asy \ lee.auto
\ ================================================================
set.act
set.let.auto
set.123.auto
\ for P N E -- set.let and set.123 are Moved into word within set.act
lee.auto
\ ----------------------------------------------------------------
\ \ Keep all default setings for all the above inputs
```



```
\ ================================================================
\ ---------------------------------- ■ \ \ For Blowup
\ act.all
\
\ act.all.1 \ LMS
\ act.all.2 \ ONA
\ act.all.3 \ ons
\ act.all.4 \ onc
\ act.all.5 \ bo1
\ act.all.6 \ bo2
\ act.all.7 \ bo3
\ ================================================================
\ \ Use inverse transform (i.e., <--> -1)
\ \ The first i.ele  and jwp.level is for generating wavelet curve
\ \ The second i.ele is for blowup
\ \ The second jwp.level is for blowup scale (i.e., Eq. to n.power -
   jwp.level)
\ set.let
\ set.123
\ blow
\ ================================================================
\ ----------------------------------------------------------------
\ ================================================================

\ ================================================================
: ColRowIni
  1  gp.flag  :=
  1  file.no  :=
  \ 1  plot.gp  :=
  plot.gp 1 +  plot.gp  :=
  \
  i.ele  2  jwp.level **  <=
  if
     " Phi-"  PhiPsi.str ":=
  else
     " Psi-"  PhiPsi.str ":=
  then
;
\ : rename.wks \ [ "str - ]
\   cdanow
\   123.file.name defer> rename \ copy
\   tmp.s.u  "cat " .wks" "cat
\   "dup
\   defer> to
\   defer> delete
\ ;
: rename.wks \ [ "str - ]
  cdanow
  123.file.name defer> copy
  tmp.s.u  "cat " .wks" "cat
  defer> to
  123.file.name defer> delete
;
: copy.wks \ [ "str - ]
  cdanow
```

```
  123.file.name defer> copy                                          106
  tmp.s.u  "cat " .wks" "cat
  defer> to
\ cdanow
\ 123.file.name defer> copy
\ " 000.wks" defer> to                                               111
;
8 string copy.type
: app.wks.col
  " $$[(" file.no 0 n>s "cat " ," "cat
  123.ary.n []size swap drop 0 n>s "cat                              116
  " ) " "cat
  tmp.s.u  "cat
  " -P" "cat
  wp.flag  0 n>s "cat
\   " L" "cat jwp.level 0 n>s "cat                                   121
  " J" "cat
  123.ary.s "[ 1 ] ":=
  123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n
  \
  to.123                                                             126
  file.no 1 + file.no := \ post inc of column
  \ ---------------------------------------- ■
  copy.type
  rename.wks \ copy.wks
;                                                                    131

: to.wks
  " P" wp.flag  0 n>s "cat
  " L" "cat jwp.level 0 n>s "cat
  " _BP"  "cat 2 jwp.level 1 + ** 0 n>s "cat                         136
  "  Ori" "cat i.ele 0 n>s "cat
  123.ary.s "[ 1 ] ":=
  \ swt.t becomes> 123.ary.n
  swp.t becomes> 123.ary.n
  to.123                                                             141
  cr cr ." Column.#"  file.no n.type
  file.no 1 + file.no :=
;
\ ================================================================
\ ================================================================  146
: wbp.set.ini
\ 1 wp.flag :=
1 jwp.level :=
ColRowIni
1 file.no :=                                                         151
set.let.auto
set.123.auto
;
\ ---------------------------------------- ■
\ ================================================================  156
: wbp.scale.4
wbp.set.ini

1   jwp.level :=
```



```
48  i.ele     :=                                                     161
lee.auto
to.wks

2   jwp.level :=
48  i.ele     :=                                                     166
lee.auto
to.wks

3   jwp.level :=
48  i.ele     :=                                                     171
lee.auto
to.wks

4   jwp.level :=
48  i.ele     :=                                                     176
lee.auto
to.wks
;
\ ----------------------------------------------------------------
: wbp.scale.6.70                                                     181
wbp.set.ini

0   jwp.level :=
70  i.ele     :=
lee.auto                                                             186
to.wks

1   jwp.level :=
70  i.ele     :=
lee.auto                                                             191
to.wks

2   jwp.level :=
70  i.ele     :=
lee.auto                                                             196
to.wks

3   jwp.level :=
70  i.ele     :=
lee.auto                                                             201
to.wks

4   jwp.level :=
70  i.ele     :=
lee.auto                                                             206
to.wks

5   jwp.level :=
70  i.ele     :=
lee.auto                                                             211
to.wks
;
\ ----------------------------------------------------------------
: wbp.scale.6.100
```

```
wbp.set.ini                                                          216

0   jwp.level :=
100  i.ele     :=
lee.auto
to.wks                                                               221

1   jwp.level :=
100  i.ele     :=
lee.auto
to.wks                                                               226

2   jwp.level :=
100  i.ele     :=
lee.auto
to.wks                                                               231

3   jwp.level :=
100  i.ele     :=
lee.auto
to.wks                                                               236

4   jwp.level :=
100  i.ele     :=
lee.auto
to.wks                                                               241

5   jwp.level :=
100  i.ele     :=
lee.auto
to.wks                                                               246
;
\ ------------------------------------------------------------------
: del.and.rento
  "dup
  defer> delete                                                      251
  "swap
  defer> rename
  defer> to
;
\ " WB3ON11C.WKS" " WBON11C3.WKS" del.and.rento                       256
\ ==================================================================
\ ==================================================================
" on22a" wlet ":=
\ ------------------------------------------------------------------
wlet tmp.s.u ":=                                                     261
tmp.s.u "upper "drop
\ ------------------------------------------------------------------
1 wp.flag :=
\ ---------------------------------------- ■
" WP1" copy.type ":=                                                 266
wbp.scale.4
app.wks.col
\ ---------------------------------------- ■
" WP2" copy.type ":=
```



```
wbp.scale.6.70                                                       271
app.wks.col
\ ---------------------------------------- -
" WP3" copy.type ":=
wbp.scale.6.100
app.wks.col                                                          276
\ ------------------------------------------------------------------
0 wp.flag :=
\ ---------------------------------------- -
" WB1" copy.type ":=
wbp.scale.4                                                          281
app.wks.col
\ ---------------------------------------- -
" WB2" copy.type ":=
wbp.scale.6.70
app.wks.col                                                          286
\ ---------------------------------------- -
" WB3" copy.type ":=
wbp.scale.6.100
app.wks.col
\ ==================================================================  291
cdanow
" WP1" tmp.s.u "cat " .wks" "cat
" WP" tmp.s.u "cat " 1.wks" "cat del.and.rento
" WP2" tmp.s.u "cat " .wks" "cat
" WP" tmp.s.u "cat " 2.wks" "cat del.and.rento                        296
" WP3" tmp.s.u "cat " .wks" "cat
" WP" tmp.s.u "cat " 3.wks" "cat del.and.rento

" WB1" tmp.s.u "cat " .wks" "cat
" WB" tmp.s.u "cat " 1.wks" "cat del.and.rento                        301
" WB2" tmp.s.u "cat " .wks" "cat
" WB" tmp.s.u "cat " 2.wks" "cat del.and.rento
" WB3" tmp.s.u "cat " .wks" "cat
" WB" tmp.s.u "cat " 3.wks" "cat del.and.rento
                                                                     306
\ ==================================================================
" on11c" wlet ":=
\ ------------------------------------------------------------------
wlet tmp.s.u ":=
tmp.s.u "upper "drop                                                 311
\ ------------------------------------------------------------------
1 wp.flag :=
\ ---------------------------------------- -
" WP1" copy.type ":=
wbp.scale.4                                                          316
app.wks.col
\ ---------------------------------------- -
" WP2" copy.type ":=
wbp.scale.6.70
app.wks.col                                                          321
\ ---------------------------------------- -
" WP3" copy.type ":=
wbp.scale.6.100
app.wks.col
```

```
\ ------------------------------------------------------------------
0 wp.flag :=
\ ---------------------------------------- -
" WB1" copy.type ":=
wbp.scale.4
app.wks.col
\ ---------------------------------------- -
" WB2" copy.type ":=
wbp.scale.6.70
app.wks.col
\ ---------------------------------------- -
" WB3" copy.type ":=
wbp.scale.6.100
app.wks.col
\ ==================================================================
cdanow
" WP1" tmp.s.u "cat " .wks" "cat
" WP" tmp.s.u "cat " 1.wks" "cat del.and.rento
" WP2" tmp.s.u "cat " .wks" "cat
" WP" tmp.s.u "cat " 2.wks" "cat del.and.rento
" WP3" tmp.s.u "cat " .wks" "cat
" WP" tmp.s.u "cat " 3.wks" "cat del.and.rento

" WB1" tmp.s.u "cat " .wks" "cat
" WB" tmp.s.u "cat " 1.wks" "cat del.and.rento
" WB2" tmp.s.u "cat " .wks" "cat
" WB" tmp.s.u "cat " 2.wks" "cat del.and.rento
" WB3" tmp.s.u "cat " .wks" "cat
" WB" tmp.s.u "cat " 3.wks" "cat del.and.rento
```

R_Pha.shl

A01751-20161209-A005 ❖ December 9, 2016 ❖ [Page count: 5]

```
: R_Pha.shl ; \ Wavelet $m_{0}$ phase \ -*- txt:asy -*-                    1

\ ================================================================
fa sd
1024 n.wt1 :=
cdtNow load LLet-000.asy \                                                 6

\ ================================================================
\ ----------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=                                            11
  512  n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  1    i.inc    :=             \ array index Inc for sub-sampling
  0    abs.flag    :=          \ absolute value norm
\   0.975 norm.keep.p.best :=   \ percentage of norm energy kept          16
\   0    filter.flag :=         \ for initial filtering
\   60   p.b.e :=               \ Pass band end (Hz)
\   30   t.w   :=               \ Transition width (Hz)
\   0    best.flag   :=         \ unclear, possibly not necessary (WPM)
\   100  #.div :=                                                         21
;
\ \ ----------------------------------------------------------------
\ : ini.par.f
\   " f0w6020.2" now.file ":=
\   512  n.wt1    :=                                                     26
\   40   s.freq.keep :=          \ Sampling freq -- original rate
\   1    i.inc    :=             \ array index Inc for sub-sampling
\   0    abs.flag    :=          \ absolute value norm
\   0    filter.flag :=         \ percentage of norm energy kept
\   0.975 norm.keep.p.best :=   \ for initial filtering                   31
\   6.0  p.b.e :=               \ Pass band end (Hz)
\   6.0  t.w   :=               \ Transition width (Hz)
\   0    best.flag   :=         \ unclear, possibly not necessary (WPM)
\   100  #.div :=               \ foe entropy calculation
\ ;                                                                       36
: ini.par.b
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200  s.freq.keep :=          \ Sampling freq -- original rate
  4    i.inc    :=             \ array index Inc for sub-sampling         41
  0    abs.flag    :=          \ absolute value norm
;
\ ----------------------------------------------------------------
-1   isign := \ ." <- or -> :"
" P" act.flag.str ":= \ 3    act.flag :=                                  46
ini.par.b
\ ini.par.chirp.al

\ ================================================================
set.act cr                                                                51
set.let
```



```
set.123
lee
\ \ set.let and set.123 are Moved into word within set.act
\ act.all                                                                 56

: ColRowIni
  1  gp.flag  :=
  1  file.no  :=
  \ 1  plot.gp  :=                                                        61
  plot.gp 1 +  plot.gp  :=
  \
  i.ele  2  jwp.level **  <=
  if
     " PHI-"  PhiPsi.str ":=                                              66
  else
     " PSI-"  PhiPsi.str ":=
  then
;
: app.ramp.col                                                            71
  wlet tmp.s.u ":=
  tmp.s.u "upper "drop
  " $$[(" file.no 0 n>s "cat " ," "cat
  123.ary.n []size swap drop 0 n>s "cat
  \ " ) " "cat tmp.s.u "cat " -" "cat " <" "cat                           76
  " ) " "cat " <" "cat
  \ ---------------------------------------- ■
  " m_0" "cat
  \ ---------------------------------------- ■
  " >]" "cat                                                              81
  123.ary.s "[ 1 ] ":=
  \
  123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n
  \
  to.123                                                                  86
  file.no 1 + file.no := \ post inc of column
;

\ ---------------------------------------- ■
\ 0 plot.gp  :=                                                           91
\ ColRowIni  " psi-LMS.wks"   " 000.wks"  set.123.BP   act.all.1 \ LMS
\ ColRowIni  " psi-ONA.wks"   " 000.wks"  set.123.BP   act.all.2 \ ONA
\ ColRowIni  " psi-ONS.wks"   " 000.wks"  set.123.BP   act.all.3 \ ONS
\ ColRowIni  " psi-ONC.wks"   " 000.wks"  set.123.BP   act.all.4 \ ONC
\ ColRowIni  " psi-BO1.wks"   " 000.wks"  set.123.BP   act.all.5 \ BO1    96
\ ColRowIni  " psi-BO2.wks"   " 000.wks"  set.123.BP   act.all.6 \ BO2
\ ColRowIni  " psi-BO3.wks"   " 000.wks"  set.123.BP   act.all.7 \ BO3
\ ------------------------------------------------------------------
ACT.Gp.Ini
ColRowIni " Pha-" " LMS.wks"  "cat " 0.0" set.123.BP act.Gp.LMS           101
   app.ramp.col
ColRowIni " Pha-" " ONC.wks"  "cat " 0.0" set.123.BP act.Gp.onC
   app.ramp.col
ColRowIni " Pha-" " ONA1.wks" "cat " 0.0" set.123.BP act.Gp.onA1
   app.ramp.col
ColRowIni " Pha-" " ONA2.wks" "cat " 0.0" set.123.BP act.Gp.onA2
```

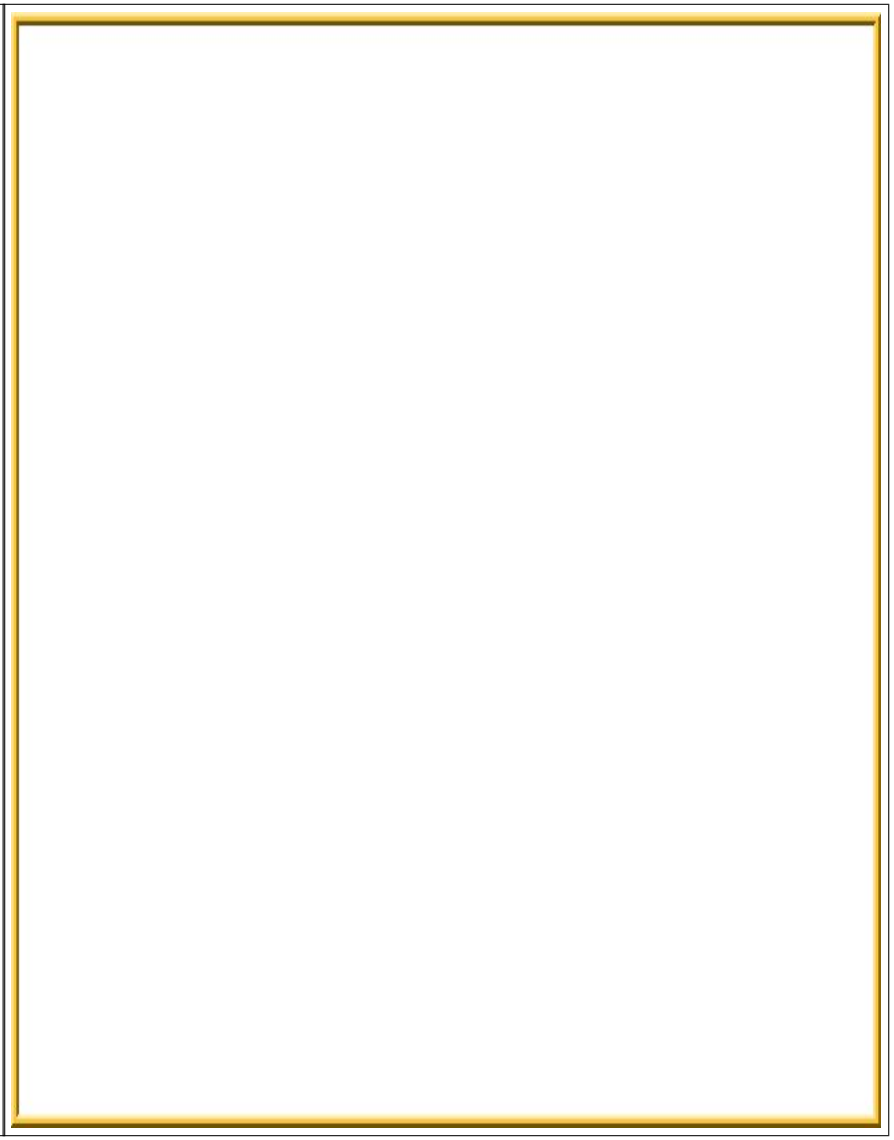
```
   app.ramp.col
ColRowIni " Pha-" " ONS1.wks" "cat " 0.0" set.123.BP act.Gp.onS1
   app.ramp.col
ColRowIni " Pha-" " ONS2.wks" "cat " 0.0" set.123.BP act.Gp.onS2
   app.ramp.col
ColRowIni " Pha-" " BO10.wks" "cat " 0.0" set.123.BP act.Gp.bo10
   app.ramp.col
ColRowIni " Pha-" " BO1D.wks" "cat " 0.0" set.123.BP act.Gp.bo1D
   app.ramp.col
ColRowIni " Pha-" " BO20.wks" "cat " 0.0" set.123.BP act.Gp.bo20
   app.ramp.col
ColRowIni " Pha-" " BO2D.wks" "cat " 0.0" set.123.BP act.Gp.bo2D
   app.ramp.col
ColRowIni " Pha-" " BO30.wks" "cat " 0.0" set.123.BP act.Gp.bo30
   app.ramp.col
ColRowIni " Pha-" " BO3D.wks" "cat " 0.0" set.123.BP act.Gp.bo3D
   app.ramp.col

\ \ : Plt.shl
\ \   cdtNow load Plt_Pha.shl \
\ \ ;
\ \ \ Plt.shl \ \ load execution depth exceeded
\
\ \ ================================================================
\ \ ----------------------------------------------------------------
\ \ ================================================================
\ \ PhiPsi.str tmp.s ":=
\ fa
\ \ 4 string PhiPsi.str
\ \ tmp.s PhiPsi.str ":=
\ \ ================================================================
\ cdt load FigA-Ini.asy \
\ 2.0 ps.linewidth.now :=
\ \ ================================================================
\ : file.name
\   stack.data " Pha-LMS.WKS"
\   stack.load " Pha-LMS.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-ONC.WKS"
\   stack.load " Pha-ONC.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-ONA1.WKS"
\   stack.load " Pha-ONA1.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
```



```
\ : file.name
\   stack.data " Pha-ONA2.WKS"
\   stack.load " Pha-ONA2.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-ONS1.WKS"
\   stack.load " Pha-ONS1.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-ONS2.WKS"
\   stack.load " Pha-ONS2.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-BO10.WKS"
\   stack.load " Pha-BO10.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-BO1D.WKS"
\   stack.load " Pha-BO1D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-BO20.WKS"
\   stack.load " Pha-BO20.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-BO2D.WKS"
\   stack.load " Pha-BO2D.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
\
\ : file.name
\   stack.data " Pha-BO30.WKS"
\   stack.load " Pha-BO30.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name
```

```
\                                                                        206
\ : file.name
\   stack.data " Pha-B03D.WKS"
\   stack.load " Pha-B03D.BPF"
\ ;
\ cdt load FigACore.asy \                                                211
\ forget file.name
\ \ ================================================================
```



R_PsiC.shl

A01752-20161209-A006 ❖ December 9, 2016 ❖ [Page count: 2]

```
: R-PsiC.shl ; \ Plot Psi Curves \ -*- txt:asy -*-
\ : PsiC-Run.asy ;

fa sd \ swd

\ %=================================================================
\ ASY: Psi (Morlet or Variant) Curve data WKS [Friday, 00/09/29 at 14
   :39:04]
\  %-----------------------------------------------------------------
\  %--------------------------------------- Generate psi function data
\  Use shell file psiC-run.asy to Generate psi function data wks file
\     Steps of implementation
\     0.  edit psiCwks.asy
\     1.  load Llet-0.asy
\     2.  load Llet-cwt.asy
\     3.  set.123
\         \   create wks file if not exist
\     4.  set.act
\         \   5
\         \   1024
\         \   start frequency:  0.6
\         \   # of frequency:1
\     5.  edit and load psiCwks.asy
\         \   to generate wks file
\         \   and then prepare, edit, or combine wks files for use in
   plotting
\         \   (see psiCplot.asy)
\ %=================================================================

\  %--------------------------------------- Generate psi function data
   wks

: new.pause
  my.pause.flag  " y"   "=
  if
    bell.1sl
    previous.window
    " <Press Key>"  s.type
    pckey  drop ?drop
    ."             "
    previous.window
  then
;

\ cdtNow load WD.asy
cdtNow load LLet-000.asy \
\ cdtNow load LLet-Rdg.asy \
cdtNow load LLet-WVT.asy \

\ ================================================================
: ini.par
  " b0w6020.4" now.file ":=
```



```
  1024 n.wt1    :=
  200  s.freq.keep :=
  5    i.inc    :=
  0.6  fre.beg  :=
  1    #.fre    :=
  0.1  fre.inc  :=
  \ 10 5 fix.format
;
\ ================================================================
1     erf.flag :=
11.0 sai.beg :=
5.00 sai.end :=
256  mat.pts :=
" N" psi.flag ":=
" C" act.flag.str ":= \ 5     act.flag :=
\ ---------------------------------------
ini.par
\ ================================================================

set.123
set.act
\ cdtNow load PsiC-Wks.asy
cdtNow load LLet-Psi.asy \
```

S_Ent.shl

A01753-20161209-A007 ❖ December 9, 2016 ❖ [Page count: 2]

```
: S_Ent.shl ; \ :: R-Ent.sel ; \ %----- Asyst Prog                          1

fa sd swd

\ cdtNow load WD.asy \
cdtNow load WDtmp.asy \ \ 2007/01/12 at 10:39:41                          6
                      \ \ g:\exp-asc\WT\  ->  g:\all-asy\Coh\
1024 n.wt1 :=
cdtNow load LLet-000.asy \
    \ ^^ Set proper length of fft.pts
                                                                          11
\ ================================================================
\ ----------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512   n.wt1    :=                                                     16
  200   s.freq.keep :=          \ Sampling freq -- original rate
  1     i.inc    :=             \ array index Inc for sub-sampling
  0     abs.flag    :=          \ absolute value norm
  0.975 norm.keep.p.best :=     \ percentage of norm energy kept
  0     filter.flag :=          \ for initial filtering                   21
  60    p.b.e :=                \ Pass band end (Hz)
  30    t.w    :=               \ Transition width (Hz)
  0     best.flag    :=         \ unclear, possibly not necessary (WPM)
  100   #.div :=
;                                                                         26
\ ----------------------------------------------------------------
: ini.par.f
  " f0w6020.2" now.file ":=
  1024 n.wt1    :=
  40    s.freq.keep :=          \ Sampling freq -- original rate          31
  1     i.inc    :=             \ array index Inc for sub-sampling
  0     abs.flag    :=          \ absolute value norm
  0     filter.flag :=          \ percentage of norm energy kept
  0.975 norm.keep.p.best :=     \ for initial filtering
  6.0   p.b.e :=                \ Pass band end (Hz)                      36
  6.0   t.w    :=               \ Transition width (Hz)
  0     best.flag    :=         \ unclear, possibly not necessary (WPM)
  100   #.div :=                \ foe entropy calculation
;
: ini.par.b                                                               41
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200   s.freq.keep :=          \ Sampling freq -- original rate
  4     i.inc    :=             \ array index Inc for sub-sampling
  0     abs.flag    :=          \ absolute value norm                     46
  0     filter.flag :=          \ percentage of norm energy kept
  0.975 norm.keep.p.best :=     \ for initial filtering
  6.0   p.b.e :=                \ Pass band end (Hz)
  6.0   t.w    :=               \ Transition width (Hz)
  0     best.flag    :=         \ unclear, possibly not necessary (WPM)   51
  100   #.div :=                \ foe entropy calculation
```



```
;
\ ================================================================
-1    isign := \ ." <- or -> :"
" E" act.flag.str ":= \ 3     act.flag :=                                 56
ini.par.b
\ ini.par.chirp.al
\ ================================================================
set.act
\ set.let and set.123 are Moved into word within set.act                  61
act.all
```

S_Nor.shl

A01754-20161209-A008 ❖ December 9, 2016 ❖ [Page count: 2]

```
: S_Nor.shl ; \ : R-Nor.sel ; \ %----- Asyst Prog                          1

fa sd swd

\ cdtNow load WD.asy \
cdtNow load WDtmp.asy \ \ 2007/01/12 at 10:39:41                          6
                      \ \ g:\exp-asc\WT\  ->  g:\all-asy\Coh\
1024 n.wt1 :=
cdtNow load LLet-000.asy \
    \ ^^ Set proper length of fft.pts
                                                                          11
\ ====================================================================
\ --------------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512   n.wt1    :=                                                     16
  200   s.freq.keep :=          \ Sampling freq -- original rate
  1     i.inc    :=             \ array index Inc for sub-sampling
  0     abs.flag    :=          \ absolute value norm
  0.975 norm.keep.p.best :=     \ percentage of norm energy kept
  0     filter.flag :=          \ for initial filtering                   21
  60    p.b.e :=                \ Pass band end (Hz)
  30    t.w    :=               \ Transition width (Hz)
  0     best.flag    :=         \ unclear, possibly not necessary (WPM)
  100   #.div :=
;                                                                         26
\ --------------------------------------------------------------------
: ini.par.f
  " f0w6020.2" now.file ":=
  1024 n.wt1    :=
  40    s.freq.keep :=          \ Sampling freq -- original rate          31
  1     i.inc    :=             \ array index Inc for sub-sampling
  0     abs.flag    :=          \ absolute value norm
  0     filter.flag :=          \ percentage of norm energy kept
  0.975 norm.keep.p.best :=     \ for initial filtering
  6.0   p.b.e :=                \ Pass band end (Hz)                      36
  6.0   t.w    :=               \ Transition width (Hz)
  0     best.flag    :=         \ unclear, possibly not necessary (WPM)
  100   #.div :=                \ foe entropy calculation
;
: ini.par.b                                                               41
  " b0w6020.4" now.file ":=
  1024 n.wt1    :=
  200   s.freq.keep :=          \ Sampling freq -- original rate
  4     i.inc    :=             \ array index Inc for sub-sampling
  0     abs.flag    :=          \ absolute value norm                     46
  0     filter.flag :=          \ percentage of norm energy kept
  0.975 norm.keep.p.best :=     \ for initial filtering
  6.0   p.b.e :=                \ Pass band end (Hz)
  6.0   t.w    :=               \ Transition width (Hz)
  0     best.flag    :=         \ unclear, possibly not necessary (WPM)   51
  100   #.div :=                \ foe entropy calculation
```



```
;
\ --------------------------------------------------------------------
-1    isign := \ ." <- or -> :"
" N" act.flag.str ":= \ 3 act.flag :=                                     56
ini.par.b
\ ini.par.chirp.al

\ ====================================================================
set.act                                                                   61
\ set.let and set.123 are Moved into word within set.act
act.all

.....
```

S_WPM.shl

A01755-20161209-A009 ❖ December 9, 2016 ❖ [Page count: 2]

```
: S_WPM.sel ; \ -*- txt:asy -*-

fa sd swd

: new.pause
  my.pause.flag  " y"   "=
  if
    bell.1sl
    previous.window
    " <Press Key>"  s.type
    pckey  drop ?drop
    ."              "
    previous.window
  then
;

\ cdtNow load WDtmp.asy \

512 n.wt1 :=
cdtNow load LLet-000.asy \
    \ ^^ Set proper length of fft.pts
\
\ ===================================================================
: ini.par
  " b0w6020.4" now.file ":=
  1024 n.wt1   :=
  200  s.freq.keep :=
  5    i.inc   :=
  1    best.flag   :=
;
\ -------------------------------------------------------------------
: ini.par.chirp.al
  " Chirp-al.dat" now.file ":=
  512  n.wt1   :=
  200  s.freq.keep :=
  1    i.inc   :=
  1    best.flag   :=
;
\ ===================================================================
" N" act.flag.str ":= \ 3    act.flag :=
\ ini.par
ini.par.chirp.al
\ ----------------------------------------
1        isign := \ ." <- or -> :"
1        wp.flag := \ WP(1) or WB(0)
" ON55C" wlet ":=
\ ===================================================================
set.act \ Chose 3
action
my.pause sd
get.map
```

S_WVT.shl

A01756-20161209-A010 ❖ December 9, 2016 ❖ [Page count: 2]

```
: S_WVT.shl ; \ %----- Asyst Prog                                        1
\ : R-Rdg.sel ; \ %----- Asyst Prog
\ Shell File for Wavelet Variant Transforms and Adapted CWT

fa sd swd
512 n.wt1 :=                                                            6
\ ================================================================
: new.pause
  my.pause.flag  " y"   "=
  if
    bell.1sl                                                           11
    previous.window
    " <Press Key>"  s.type
    pckey  drop ?drop
    ."              "
    previous.window                                                    16
    \     bell.flag :=  \ restore
  then
;
\ ================================================================
cdtNow load LLet-000.asy \                                             21
cdtNow load LLet-WVT.asy \
\ cdtNow load LLet-Rdg.asy \
\ ================================================================
: ini.par
  " b0w6020.4" now.file ":=                                            26
  1024 n.wt1   :=
  200  s.freq.keep :=
  5    i.inc   :=
  1.6  fre.beg :=
  40   #.fre   :=                                                      31
  0.1  fre.inc :=
;
: ini.par.f
  5    act.flag :=
  " f0w6020.2" now.file ":=                                            36
  1024 n.wt1   :=
  40   s.freq.keep :=
  1    i.inc   :=
  1.6  fre.beg :=
  40   #.fre   :=                                                      41
  0.1  fre.inc :=
;
: ini.par.chirp
  5    act.flag :=
  " Chirp-al.dat" now.file ":=                                         46
  512  n.wt1   :=
  200  s.freq.keep :=
  1    i.inc   :=
  5    fre.beg :=
  20   #.fre   :=                                                      51
  5    fre.inc :=
```



```
;
\ ============================================================
\ ------------------------------------------------------------
" C" act.flag.str ":= \ 5    act.flag :=                               56
1    erf.flag :=
11.0 sai.beg :=
5.00 sai.end :=
256  mat.pts :=
\ " N" psi.flag ":=                                                    61
" O" psi.flag ":=
10 5 fix.format
\ ----------------------------------------
\ ini.par
\ ini.par.f                                                            66
ini.par.chirp
\ ============================================================
set.act \ Choose 5
sd echo.off
: choose.e.m                                                           71
  cr
  ." Choose data type to send to MMA (E: Hilbert envelop; M: Modulus): "
  " E" "dup get.str "=
  if
    to.mat.e.p                                                         76
  else
    to.mat.m.p
  then
;
choose.e.m                                                             81
```

S_Coh_WC.Shl

A01757-20161209-A011 ❖ December 9, 2016 ❖ [Page count: 3]

```
: S_Coh_WC.Shl ; \ : WC_S.sel ; \ -*- txt:asy -*-                          1
\ \  2004/09/10 at 14:47:02
\ \  123-A2W.asy  -> 123-A2Wn.asy
\ ------------------------------------------------------------------

fa sd \ swd                                                                6

integer scalar #.fft.pts scalar #.pts
2 string SC.or.WC

" WC" SC.or.WC ":=                                                        11
: spe.coh
  \ dummy; used in Coh_BP.bp
;
512 n.wt1 :=
\ ================================================================       16
: new.pause
  my.pause.flag  " y"   "=
  if
    bell.1sl
    previous.window                                                       21
    " <Press Key>"  s.type
    pckey  drop ?drop
    ."                "
    previous.window
  then                                                                    26
;

\  %--------------------------------------- Generate Coherence Data for
    Plots
\  Use the shell file "WC-run.asy" to run wavelet coherence:
\     The steps to implement                                              31
\     0.  edit  WC-BP.bp                 Define the coherence pairs (
   get.bat)
\     1.  load  LLet-0.asy
\     2.  load  LLet-cwt.asy
\     3.  Load  WC-0.asy
\     4.  set.act                        Initialize a few parameters      36
\         % 5.  % set.123                        Preparing wks files
\         % 6.  % set.coh                        Initializing some
   parameters
\         % 7.  % run.coh   OK!

\ ================================================================       41
cdtNow load LLet-000.asy \    \  2007/01/12 at 10:03:51
\ cdtNow load LLet-00n.asy \ \  2004/09/10 at 14:03:02
\                            \  123-A2W.asy    -> 123-A2Wn.asy
\                            \  Replace All [dir.lee.asc] to [
   cda.now.str]
\                            \  dir.lee.asc    -> cda.now.dir            46
\                            \  g:\Exp-Asc\WT -> g:\Exp-Asc\Coh
cdtNow load LLet-WVT.asy \    \  2007/01/12 at 10:03:51
```



```
\ cdtNow load LLet-Rdg.asy \ \  2007/01/12 at 10:03:51
cdtNow load LLet-Coh.asy \
\ cdtNow load LLet-WC.asy \                                               51
\ \ cdtNow load LLet-WCo.asy \ LLet-WCo-200010161021.asy & WC-BP.bp
\ ================================================================

: ini.par.a.b.p.q.i5
  \ " b0w6020.4" now.file ":=                                             56
  1024 n.wt1   :=
  200  s.freq.keep :=
  5    i.inc   :=
  0.1  fre.beg :=
  90   #.fre   :=                                                         61
  0.1  fre.inc :=
  256  mat.pts :=
  \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ ■
  \ " 0-WC-A.wks" cda.now.str "swap "cat 123.file.name ":=
  \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ ■                            66
;
: ini.par.f
  \ " f0w6020.2" now.file ":=
  1024 n.wt1   :=
  4096 n.wt1   :=                                                         71
  40   s.freq.keep :=
  1    i.inc   :=
  0.1  fre.beg :=
  100  #.fre   :=
  0.1  fre.inc :=                                                         76
  256  mat.pts :=
  \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ ■
\   1    fre.beg :=
\   10   #.fre   :=
\   1    fre.inc :=                                                       81
  \ " 0-WC-FR.wks" cda.now.str "swap "cat 123.file.name ":=
  \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ _
;
\ : ini.par
\   now.file 1 "left "upper " F" "=                                       86
\   if
\     ini.par.f
\   else
\     ini.par.a.b.p.q.i5
\   then                                                                  91
\   256  mat.pts :=
\ ;
\ ----------------------------------------------------------------
: Ini.input.data.type
\   cr ." Batch Processing Data Type" " Coh_BP.bp ::" s.type.2            96
\   cr ."                                             F: F series"
\   cr ."                                             B: A(P), B(Q), ...
   series"
\   cr ."                                             " input.data.type.flag
    get.str
\   "dup s.type
\   "upper input.data.type.flag ":=                                       101
```

```
  input.data.type.flag " F" "=
  if
    ini.par.f
  else
    ini.par.a.b.p.q.i5                                          106
  then
  \    256  mat.pts :=
;
\ ------------------------------------------------------------------
\ ==================================================================  111
" N" psi.flag ":=
" W" act.flag.str ":= \ 6     act.flag :=
" C" rea.or.com ":=
1     erf.flag :=
11.0 sai.beg :=                                                 116
5.00 sai.end :=
\ ---------------------------------------- -
Ini.input.data.type
specify.now.file \ Redefine ini data
\ ini.par                                                       121
\     1024 n.wt1    :=
\ ==================================================================
set.act
```

S_Coh_SC.Shl

A01758-20161209-A012 ❖ December 9, 2016 ❖ [Page count: 9]

```
: S_Coh_SC.shl ; \ : SC_S.shl ; \ -*- txt:asy -*-
\ ------------------------------------------------------------------
\ Shell for Spectral Coherence
\ 1. Modify word ini.par... in accord with get.bat
\ 2. Modify SCWC_B.bp (through assigning word get.bat) for batch
   processing
\ ------------------------------------------------------------------
fa sd
\ ==================================================================
cdt load 123-A2W.asy \        \   2007/01/12 at 10:03:51
\ cdt load 123-A2Wn.asy \     \   2004/09/10 at 14:03:02
\                             \   123-A2W.asy    -> 123-A2Wn.asy
\                             \   Replace All [dir.lee.asc] to [
   cda.now.str]
\                             \   dir.lee.asc    -> cda.now.dir
\                             \   g:\Exp-Asc\WT -> g:\Exp-Asc\Coh

integer scalar #.fre      scalar exp.flag       scalar mat.inc
        scalar mat.beg    scalar mat.pts        scalar mat.power
        scalar i.inc      scalar i.inc.ramp     scalar vi1
        scalar #.fft.pts  scalar fft.sec        scalar vi2
        scalar s.freq     scalar s.freq.ori
        scalar i.beg      scalar #.pts
        scalar f.cut.i
real scalar sai.beg  scalar sai.end  scalar sai.now  scalar a.sca
     scalar fre.beg  scalar fre.end  scalar fre.now  scalar fre.inc
     scalar e.g2.sum scalar e.h2.sum scalar f.cut
token q.coef    exp.mem> q.coef
token a.token   exp.mem> a.token
token b.token   exp.mem> b.token
token gt.t      exp.mem> gt.t
token ht.t      exp.mem> ht.t
token u.t       exp.mem> u.t
token v.t       exp.mem> v.t
token t.t       exp.mem> t.t
16 string wlet
\ 1  string rea.or.com    1 string h.w.flag
\ 1  string h.w.flag.1    1 string h.w.flag.2
1  string yadp.flag
12 string now.file
12 string now.file.1
12 string now.file.2
1 string rea.or.com

: get.sigs
  now.file.2 ":=
  now.file   ":=
\  \    now.file    1  "right  " 1"  "=
\  \    now.file    1  "right  " 2"  "= or
\  \    if
\  \      " w" h.w.flag.1 ":=
\  \    else
```



```
\  \      " h" h.w.flag.1 ":=
\  \    then
\  \    now.file.2  1  "right  " 1"  "=
\  \    now.file.2  1  "right  " 2"  "= or
\  \    if
\  \      " w" h.w.flag.2 ":=
\  \    else
\  \      " h" h.w.flag.2 ":=
\  \    then
  now.file   1 2 "sub       now.file   4 1 "sub "cat
  now.file   6 1 "sub "cat  now.file   1 "right "cat
  " -" "cat
  now.file.2 2 1 "sub "cat  now.file.2 4 1 "sub "cat
  now.file.2 6 1 "sub "cat  now.file.2 1 "right "cat
  "upper
  123.ary.s "[ 1 ] ":=
  dir.lee.asc  now.file    "cat  ftoa.bat
  \ get.sub.a.2d
  i.beg 0 >
  if
    sub[ i.beg ,  #.pts ]
  then
  becomes>  u.t        \ data
  dir.lee.asc  now.file.2  "cat  ftoa.bat
  \ get.sub.a.2d
  i.beg 0 >
  if
    sub[ i.beg ,  #.pts ]
  then
  becomes>  v.t        \ data
;
: get.sub.a.2d
  []size  #.fft.pts i.inc *  float /  floor   fft.sec  :=
  0   vi2 :=
  dup
  begin
    vi2 1 +  vi2  :=
    0   tmp.v.i :=
    begin
      tmp.v.i  1 +  tmp.v.i  :=
      tmp.v.i 1 >
      if
        over
        sub[ tmp.v.i 1 -  2 n.power **  *  vi2 + , 2 n.power ** , i.inc
           ]
        laminate
      else
        sub[ tmp.v.i 1 -  2 n.power **  *  vi2 + , 2 n.power ** , i.inc
           ]
      then
      tmp.v.i  fft.sec =
    until
    vi2  i.inc.ramp  =
  until
;
```

```
: sig.t.exp
    exp.flag 1 =
    if                                                                  106
      gt.t  sub[ 1 , 2 n.power 1 - ** ] rev[ 1 ]
      gt.t
      catenate
      gt.t  sub[ 2 n.power 1 - **  1 + , 2 n.power 1 - ** ] rev[ 1 ]
      catenate                                                          111
    else
      gt.t
    then
    becomes>  gt.t
    exp.flag 1 =                                                        116
    if
      ht.t  sub[ 1 , 2 n.power 1 - ** ] rev[ 1 ]
      ht.t
      catenate
      ht.t  sub[ 2 n.power 1 - **  1 + , 2 n.power 1 - ** ] rev[ 1 ]    121
      catenate
    else
      ht.t
    then
    becomes>  ht.t                                                      126
;
: get.exp.sub
    exp.flag 1 =
    if
    \ sub[ 2 n.power 1 - **  1 + , 2 n.power ** ]  \ for CWT.coh        131
      sub[ 1   , 2 n.power ** , 2  ]               \ for SPE.coh   = 0
    \ sub[ 2   , 2 n.power ** , 2  ]               \ for SPE.coh
    else
    then
;                                                                       136
: spe.coh  \ [ "f1.dat" , "f2.dat" -- ]
  dp.real.fft
  #.fft.pts  my.power
  get.sigs   \ u.t v.t
  2                                                                     141
  exp.flag  1 =
  if
    n.power 1 +
  else
    n.power                                                             146
  then
  **  real ramp becomes> q.coef
  0.  q.coef :=
  q.coef  becomes>  a.token
  q.coef  becomes>  b.token                                             151
  q.coef  q.coef z=x+iy  becomes>  q.coef

  u.t []size  #.fft.pts i.inc *  float /  floor   fft.sec  :=  drop

  0   vi2 :=                                                            156
  begin
    vi2 1 +  vi2  :=
```



```
    0   tmp.v.i :=
    6 3 fix.format
    cr  ."    Ramp:"   vi2 .                                            161
    \ cr   vi2 .
    begin
      tmp.v.i  1 +  tmp.v.i  :=
      tmp.v.i n.type
      u.t  sub[ tmp.v.i 1 -  2 n.power **  *  vi2 + , 2 n.power ** ,   166
         i.inc ]
      becomes> gt.t
      v.t  sub[ tmp.v.i 1 -  2 n.power **  *  vi2 + , 2 n.power ** ,
         i.inc ]
      becomes> ht.t
      sig.t.exp
                                                                        171
      gt.t   fft               \ F^(w)
\      get.exp.sub
      dup  zmag    2  **  a.token  +  a.token  :=     \ square first

      ht.t   fft               \ F^(w)                                  176
      conj
\      get.exp.sub
      dup  zmag    2  **  b.token  +  b.token  :=     \ square first

      *   q.coef                   +  q.coef   :=                       181

      tmp.v.i  fft.sec =
    until
    vi2  i.inc.ramp  =
  until                                                                 186

  exp.flag 1 =
  if
    1. a.token [ 2 n.power ** 1 + ]  :=
    1. b.token [ 2 n.power ** 1 + ]  :=                                191
  then

  q.coef  zmag   2  **                              \ sum  first
  a.token /  b.token  /
                                                                        196
  get.exp.sub

  becomes> q.coef
  hp  q.coef  sub[ 1 , 2 n.power 1 - ** ]
      2 n.power 1 - **  real ramp  s.freq *  2 n.power 1 - ** /         201
\  hp  q.coef
\      2 n.power **  real ramp  s.freq *  2 n.power  ** /
      swap  1 xyap
;
: set.spe.coh                                                           206
  5 0 fix.format
  cr ." Beginning point (0->Full signal):" i.beg get.val i.beg :=
  i.beg  0 <>
  if
\   cr ." Sub-Length (#.pts) [1024*5=]:"   #.pts i.inc * get.val #.pts  211
```

```
    :=
\    cr ." Sub-Length (#.pts) [1024*5=]:"    #.pts i.inc * get.val #.pts
    :=
\    cr ." Sub-Length (#.pts) [1024*5=]:"    #.pts i.inc * get.val #.pts
    :=
     cr ." Sub-Length (#.pts) [1024*i.inc=]:"    #.pts i.inc * get.val #
        .pts :=
\    cr ." Sub-Length (#.pts) [1024*5=]:"    #.pts i.inc * get.val #.pts
    :=
  then                                                                  216
  cr
  cr ." FFT section length (#.fft.pts):"    #.fft.pts get.val #.fft.pts
     :=
   #.fft.pts  my.power
  7 3 fix.format
  cr ." Original sampling rate :"           s.freq.ori get.val s.freq.ori  221
     :=
  4 0 fix.format
  cr ."   Sub-sampled at every `i.inc(.ramp)' point(s): "
  i.inc  get.val  i.inc.ramp :=
  i.inc.ramp      i.inc      :=
  s.freq.ori  float  i.inc.ramp float /  s.freq  :=                     226
  7 3 fix.format
  cr  " Modified sampling rate :"  s.type  s.freq  n.type
  cr ." Fre plot limit:"                    f.cut get.val f.cut :=
  4 0 fix.format
  cr                                                                    231
  cr ." Expand Flag"                        exp.flag get.val exp.flag :=
\  cr ." MAT.pts:"  256                   get.val  mat.pts  :=
\  2 n.power **  mat.pts /          mat.inc :=
\  n.power      \ for recover
\  mat.pts  my.power n.power  mat.power :=                              236
\  n.power :=  \ recover
\  1 0 fix.format
  10 5 fix.format
;
\ 1    i.inc.ramp :=                                                    241
10 5 fix.format

: get.ary
  file.no 1 +  file.no :=
  q.coef  \ []size ramp 1 -  fre.inc *  fre.beg +  swap                  246

  sub[ 1 , f.cut.i ]
\ \  []size 2 /  tmp.v.i :=
\ \  sub[ 1 , tmp.v.i ]
                                                                        251
  laminate
  q.coef
  sub[ 1 , f.cut.i ]
\ \  []size 2 /  tmp.v.i :=
\ \  sub[ 1 , tmp.v.i ]                                                 256
  becomes> 123.ary.n
  to.123
;
```



```
: get.arys
  q.coef  []size ramp 1 -  fre.inc *  fre.beg +  swap                   261
;
: plot.coh
  1 file.no :=
  begin
    file.no  1 + file.no :=                                             266
    q.coef   xsect[ 1       , ! ]
      sub[ 1 , f.cut.i ]
\ \    sub[ 1 , 100 ]
    q.coef   xsect[ file.no , ! ]
      sub[ 1 , f.cut.i ]                                                271
\ \    sub[ 1 , 100 ]
\   file.no 1 -  -  roll []size ramp 1 -  fre.inc *  fre.beg +  swap
\   []size ramp 1 -  fre.inc *  fre.beg +  swap
    file.no 1 -   1 =
    if                                                                  276
      file.no  1 -  xyap
    else
      yadp.flag  " a"  "=
      if
        file.no  1 - xyap                                               281
      else
        file.no  1 - xydp
      then
    then
    line.c   color                                                      286
    file.no  1 -  0  n>s  label
    file.no  1 -  vi1 =
  until
;                                                                       291
\ : get.bat ;
2 string SC.or.WC
" SC" SC.or.WC ":=
: cwt.coh
  \ dummy; used in Coh_BP.bp                                            296
;
: load.bp.file
   cr ." File name of batch processing pairs :"
   cdtNow
   stack.load " Coh_BP.bp"                                              301
   \ stack.load " B.B"
   get.str  tmp.s ":=
   tmp.s defer> load
;
load.bp.file                                                            306

: run.coh
  2 n.power **  real ramp  s.freq *  2 n.power  ** /

  dup becomes> t.t                                                      311
  0  tmp.v.i  :=
  begin
    tmp.v.i 1 +  tmp.v.i :=
```

```
    t.t  [ tmp.v.i ]   f.cut >
  until
  tmp.v.i 1 -  f.cut.i :=
  sub[ 1 , f.cut.i ]

\   []size 2 /  tmp.v.i :=
\   sub[ 1 , tmp.v.i ]

  0 file.no :=

  get.bat

  file.no  vi1 :=

  becomes> q.coef  \ laminated

  file.no 1 +  file.no  :=

\ \  " $$[("        file.no 0 n>s  "cat  " ," "cat  tmp.v.i 0 n>s "cat
    " ]" "cat
\   " $$[("        file.no 0 n>s  "cat  " ," "cat  f.cut.i 0 n>s "cat  "
    )]" "cat
  " $$[("       file.no 0 n>s  "cat  " ," "cat  f.cut.i 0 n>s "cat  " )
     " "cat
  SC.or.WC "cat " ]" "cat
  " pts="  "cat  #.fft.pts  0 n>s  "cat
  " ,#.sec="  "cat  fft.sec 0 n>s "cat
  " ,(f=" "cat   s.freq 0 n>s "cat
  " ,inc=" "cat  i.inc.ramp 0 n>s "cat " )" "cat
\  " ]" "cat
  123.ary.s "[ 1 ] ":=

  q.coef xsect[ 1 , ! ]   becomes> 123.ary.n
  to.123
  plot.coh
;

\
  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: ini.par.b.i4
  1    i.beg :=
  1024 #.pts :=
  256  #.fft.pts :=
  200  s.freq.ori :=
  4    i.inc :=
  4    i.inc.ramp :=
  10.0 f.cut :=
  0    exp.flag :=
;
\
  ------------------------------------------------------------------------------

: ini.par.a.b.p.q.i5
  1    i.beg :=
```



```
  1024 #.pts :=
  256  #.fft.pts :=
  200  s.freq.ori :=
  5    i.inc :=
  5    i.inc.ramp :=
  10.0 f.cut :=
  0    exp.flag :=
  \ \ ---------------------------------------- -
  \ 1024 #.pts :=
  \ " Cs1A-WC.wks" cda.now.str "swap "cat 123.file.name ":=
  \ \ ---------------------------------------- -
  \ 1024 #.pts :=
  \ " Cs1A-CC.wks" cda.now.str "swap "cat 123.file.name ":=
  \ \ ---------------------------------------- -
  \ 1024 #.pts :=
  \ " SC_AWC42.wks" cda.now.str "swap "cat 123.file.name ":=
  \ \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ _
  \ \ ---------------------------------------- -
  \ 1024 #.pts :=
  \ " SC_AWC42.wks" cda.now.str "swap "cat 123.file.name ":=
  \ \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ _
;
\
  ------------------------------------------------------------------------------

: ini.par.f
  1    i.beg :=
  1024 #.pts :=
  256  #.fft.pts :=
  40   s.freq.ori :=
  1    i.inc :=
  1    i.inc.ramp :=
  10.0 f.cut :=
  0    exp.flag :=
\   \ ======================================== -
\   \ ---------------------------------------- -
\   1024 #.pts :=
\   " SC_F1.wks" cda.now.str "swap "cat 123.file.name ":=
\   \ ---------------------------------------- -
\   2048 #.pts :=
\   " SC_F2.wks" cda.now.str "swap "cat 123.file.name ":=
\   \ ---------------------------------------- -
\   4096 #.pts :=
\   \ " Cs4F-WC.wks" cda.now.str "swap "cat 123.file.name ":=
\   " SC_F4.wks" cda.now.str "swap "cat 123.file.name ":=
\   \ ---------------------------------------- -
\   9216 #.pts :=
\   " SC_F9.wks" cda.now.str "swap "cat 123.file.name ":=
\   \ ---------------------------------------- -
\   9216 #.pts :=
\   512  #.fft.pts :=
\   " SC_F9_5.wks" cda.now.str "swap "cat 123.file.name ":=
\   \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ _
\   4096 #.pts :=
\   " SC_F4.wks" cda.now.str "swap "cat 123.file.name ":=
```

```
  \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ _
;
\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: Ini.input.data.type
\   cr ." Batch Processing Data Type" " SCWC_B.bp ::" s.type.2
\   cr ."                                         F: F series"
\   cr ."                                         B: A(P), B(Q), ...
   series"
\   cr ."                                         " input.data.type.flag
    get.str
\   "dup s.type
\   "upper input.data.type.flag ":=
  input.data.type.flag " F" "=
  if
    ini.par.f
  else
    ini.par.a.b.p.q.i5
  then
;
Ini.input.data.type
specify.now.file \ Redefine ini data
\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

set.123
set.spe.coh
run.coh
```

SWD.asy

A01759-20161209-A013 ❖ December 9, 2016 ❖ [Page count: 4]

```
: SWD.asy ; \ %----- Asyst Prog -*- txt:asy -*-

echo.off
\ fa
\ integer scalar cdtnow.flag
\  1 string cdtnow.flag.str
\ 32 string cdt.now.str
\ 32 string cda.now.str
\ 32 string cdd.now.str
32 string cdt.str
32 string cda.str
32 string cdd.str
32 string cdf.str

0 set.file.parse
\ ====================================================================
: cd.common \ [ Txt Asc Fig Dat - ]
  cdd.str ":="
  cdd.now.str ":="
  cdf.str ":="
  cdf.now.str ":="
  cda.str ":="
  cda.now.str ":="
  cdt.str ":="
  cdt.now.str ":="
\   " c:\per\asy\dat\" cdd.now.str ":=
\   " c:\per\asy\fig\" cdf.now.str ":=
\   " c:\per\asy\asc\" cda.now.str ":=
\   " c:\per\asy\txt\" cdt.now.str ":=
  \ ----------------------------------------
  cda.str dir.lee.asc ":=
  cdd.str dir.lee.dat ":=
\   cdf.now.str dir.lee.fig ":=
;
\ ====================================================================
: cdOri
  " c:\per\asy\txt\"
  " c:\per\asy\txt\"
  " c:\per\asy\asc\"
  " c:\per\asy\asc\"
  " G:\Fig\Asy\Fig\"
  " G:\Fig\Asy\Fig\"
  " c:\per\asy\dat\"
  " c:\per\asy\dat\"
  cd.common \ [ Txt Asc Fig Dat - ]
;
: cdSta
  " c:\per\asy\txt\"
  " c:\per\asy\txt\"
  " G:\Exp-Asc\tmp\"
  " G:\Exp-Asc\tmp\"
  " G:\Fig\Asy\Fig\"
```



```
  " G:\Fig\Asy\Fig\"
  " G:\Exp-Dat\WC\"
  " G:\Exp-Dat\WC\"
  cd.common
;
: cdWT
  " G:\All-Asy\WT\"
  " G:\All-Asy\WT\"
  " G:\Exp-Asc\WT\"
  " G:\Exp-Asc\WT\"
\   " G:\Fig\Asy\Fig\"
\   " G:\Fig\Asy\Fig\"
   " G:\Fig\Asy\WT\"
   " G:\Fig\Asy\WT\"
  " G:\Exp-Dat\WC\"
  " G:\Exp-Dat\WC\"
  cd.common
;
: cdDnR
  " G:\All-Asy\WDRPB\"
  " G:\All-Asy\WDRPB\"
  " G:\Exp-Asc\WDRPB\"
  " G:\Exp-Asc\WDRPB\"
  " G:\Fig\Asy\WDRPB\"
  " G:\Fig\Asy\WDRPB\"
  " G:\Exp-Dat\WC\"
  " G:\Exp-Dat\WC\"
  cd.common
;
\ : cdCoh
\   " G:\All-Asy\WC\"
\   " G:\All-Asy\WC\"
\   " G:\Exp-Asc\WC\"
\   " G:\Exp-Asc\WC\"
\   " G:\Fig\Asy\Fig\"
\   " G:\Fig\Asy\Fig\"
\   " G:\Exp-Dat\WC\"
\   " G:\Exp-Dat\WC\"
\   cd.common
\ ;
: cdCoh
  " G:\All-Asy\Coh\" \ \ cdt.now.str ":=
  " G:\All-Asy\Coh\" \ \ cdt.str ":=
  " G:\Exp-Asc\Coh\"  \ \ cda.now.str ":=
  " G:\Exp-Asc\WT\"  \ \ cda.str ":=
  " G:\Fig\Asy\Coh\" \ \ cdf.now.str ":=
  " G:\Fig\Asy\Coh\" \ \ cdf.str ":=
  " G:\Exp-Dat\WC\"  \ \ cdd.now.str ":=
  " G:\Exp-Dat\WC\"  \ \ cdd.str ":=
  cd.common
;
: cdHT
  " c:\per\asy\txt\"
  " c:\per\asy\txt\"
  " G:\Exp-Asc\WC\"
```

```
   " G:\Exp-Asc\WC\"
   " G:\Fig\Asy\Fig\"
   " G:\Fig\Asy\Fig\"
   " G:\Exp-Dat\WC\"
   " G:\Exp-Dat\WC\"
   cd.common
;
: cdMod
   " G:\All-Asy\Mod\"
   " C:\per\asy\txt\"
\   " G:\Exp-Asc\mod\"
   " G:\Exp-Asc\Asc\" \ cda.now - output
   " G:\Exp-Asc\WC\"  \ cda - input
   " G:\Fig\Asy\Fig\"
   " G:\Fig\Asy\Fig\"
   " G:\Exp-Dat\WC\"
   " G:\Exp-Dat\WC\"
   cd.common
;
: cdTmp
   " G:\All-Asy\tmp\"
   " G:\All-Asy\tmp\"
   " G:\Exp-Asc\tmp\"
   " G:\Exp-Asc\tmp\"
   " G:\Fig\Asy\Fig\"
   " G:\Fig\Asy\Fig\"
   " G:\Exp-Dat\WC\"
   " G:\Exp-Dat\WC\"
   cd.common
;
: cdPrj
   " G:\All-Asy\prj\"
   " G:\All-Asy\prj\"
   " G:\Exp-Asc\prj\"
   " G:\Exp-Asc\prj\"
   " G:\Fig\Asy\Fig\"
   " G:\Fig\Asy\Fig\"
   " G:\Exp-Dat\WC\"
   " G:\Exp-Dat\WC\"
   cd.common
;
: cdEnt
   " c:\per\asy\txt\"
   " c:\per\asy\txt\"
   " G:\Exp-Asc\WC\"
   " G:\Exp-Asc\WC\"
   " G:\Fig\Asy\Fig\"
   " G:\Fig\Asy\Fig\"
   " G:\Exp-Dat\WC\"
   " G:\Exp-Dat\WC\"
   cd.common
;
\  ================================================================
: Choose.dir.WP.str
   cdtnow.flag.str "upper
```



```
   "dup " O" "= if cdOri else cdPrj then
   "dup " S" "= if cdSta then
   "dup " W" "= if cdWT  then
   "dup " D" "= if cdDnR then
   "dup " C" "= if cdCoh then
   "dup " E" "= if cdEnt then
   "dup " H" "= if cdHT  then
   "dup " M" "= if cdMod then
   "dup " T" "= if cdTmp then
         " J" "= if cdPrj then
;
: Choose.dir.str
   cr ." Set Working Directories:"
   cr ."            "    " O: Ori (txt)" s.type
   cr ."            "    " S: Statistics (Sta)" s.type
   cr ."            "    " W: Wavelet Transform ()" s.type
   cr ."            "
   " D: Decomposition, Reconstruction, Phase , and Blowup (WDRPB)" s.type
   cr ."            "    " C: Coherence (Wavelet and Fourier Coherence) (WC)
      " s.type
   cr ."            "    " E: Entropy" s.type
   cr ."            "    " H: Hilbert Transform (HT)" s.type
   cr ."            "    " M: Modualtion (Mod)" s.type
   cr ."            "    " T: Temporary (Tmp)" s.type
   cr ."            "    " J: Project ()" s.type
   cr ."   Set to?"
   cdtnow.flag.str get.str cdtnow.flag.str ":=
   Choose.dir.WP.str
;
: show.dir
   cr ." txt     dir:" dir.lee.txt "len 1 - "left s.type
   cr ." cdtNow dir:" cdt.now.str "len 1 - "left s.type.3
   cr ." cdt     dir:" cdt.str     "len 1 - "left s.type
   cr
   cr ." cdaNow dir:" cda.now.str "len 1 - "left s.type.3
   cr ." cda     dir:" cda.str     "len 1 - "left s.type
   cr
   cr ." cdfNow dir:" cdf.now.str "len 1 - "left s.type.3
   cr ." cdf     dir:" cdf.str     "len 1 - "left s.type
   cr
   cr ." cddNow dir:" cdd.now.str "len 1 - "left s.type.3
   cr ." cdd     dir:" cdd.str     "len 1 - "left s.type
;
" M" cdtnow.flag.str ":=
" D" cdtnow.flag.str ":=
" W" cdtnow.flag.str ":=

" C" cdtnow.flag.str ":=
sc
Choose.dir.str
show.dir  cdtNow
```

LLet-000.asy

A01760-20161209-A014 ❖ December 9, 2016 ❖ [Page count: 17]

```
: LLet-000.asy ; \   -*- txt:asy -*-
\ 1.  The Core file for all Wavelet programs.
\ 2.
\
\ ---------------------------------------------------------------
\ {29.line}
\ dir.lee.txt       " nr-dwt.txt" "cat  defer>  load
echo.on

real    scalar s.freq
integer scalar n.fft.pts  scalar i.inc
26  0   29  79 window {hp.wnd}
nd
: iand \ [ n1 , n2  --  n3 ]
  #>mask   #>mask   and    mask>#
;

cdtNow load LLet-Coe.asy \
cdt load 123-A2W.asy \
cdtNow load LLet-Mai.asy \

: dp.real.flag \ To see the difference,
  real         \ keep this
  \ dp.real    \ you can exercise  a []sum for e{17}=1
;
integer scalar i.ini
        scalar i.int
        scalar i.end
        scalar i.no
        scalar up.ax.ini
        scalar up.ax.int
        scalar up.ax.end
        scalar up.ax.no
        scalar up.axmin
        scalar up.axmax
        scalar dp.ax.ini
        scalar dp.ax.int
        scalar dp.ax.end
        scalar dp.ax.no
        scalar dp.axmin
        scalar dp.axmax
        scalar ax.shf
        scalar dual.flag
        scalar i.chirp
        scalar i.envelop
integer scalar i.cou  scalar n.blow
3  string file.ext
1  string yadp.flag
64 string tmp.s.u

real    scalar t.dur
        scalar up.wxmin
```



```
        scalar up.wxmax
        scalar up.wymin
        scalar up.wymax
        scalar dp.wxmin
        scalar dp.wxmax
        scalar dp.wymin
        scalar dp.wymax
\ ================================================================
integer scalar p.pnts
: get.p.pnts
  n.wt1  my.power
  n.power  10  =  if  1000  then
  n.power   9  =  if   500  then
  n.power   8  =  if   250  then
  n.power   7  =  if   120  then
  n.power   6  =  if    80  then
  p.pnts :=
;
\ ================================================================
integer scalar chirp.spe
: initial.parameter
  " bo370"  wlet ":=
  " on88s"  wlet ":=
  " bo131"  wlet ":=
  " on22a"  wlet ":=
  " bo220"  wlet ":=
  " bo22d"  wlet ":=

  4     n.dau.c   :=
  0     wp.flag   :=
  1     isign     :=
  2     jwp.level :=

  \  1024   n.wt1     :=
  \  9   2  swap **    n.wt1     :=
  \ cr ." Wavelet length :" n.wt1 get.val n.wt1 :=
  cr ." Initialize Wavelet length (match when [DnR, Phase, Norm-WP, Ent
     ]):"
  n.wt1 get.val n.wt1 :=

  0     i.int     :=

  n.wt1  my.power

  1   isign   =
  if    \ ------------------------ \ i : freq ;
    cr
    " 0:General;  1:Envelop;  2:Chirp :: "
    s.type   0     get.val
    case  0  of                  endof
          1  of  1 i.envelop :=  endof
          2  of  1 i.chirp   :=
                 cr ." Chirp.spe:(11 Nyquist/Linear, 12, 21, 22)"
                 11 get.val chirp.spe :=
                                 endof
```

```
    endcase

    i.chirp  1  =
    if
      50      i.ini      :=    \ first executed;  small index and low line   111
        type
      1       i.no       :=
    else
      30      i.ini      :=    \ first executed;  small index and low line
        type
      1       i.no       :=
    then                                                                    116
    1         up.ax.ini  :=
    1         up.ax.int  :=
    1         up.axmin   :=
\    2  n.power **
     get.p.pnts  p.pnts                                                     121
              up.axmax   :=
    1         dp.ax.ini  :=
    1         dp.ax.int  :=
    1         dp.axmin   :=
    200       dp.axmax   :=                                                 126
  \ i.ini   i.int  i.no 1 -    *  +       i.end :=
  \ i.end  1 +                            i.end :=
  else  \ ------------------------ \ i : unit base function ;
        \ 0   2   4   8   16   32   64   128   512   1024   2048
    6         i.ini      :=    \ first executed;  small index and low line   131
        type
    5         i.end      :=    \ last executed;  small index and high line
        type
    1         i.no       :=
    1         up.ax.ini  :=
    1         up.ax.int  :=
    1         up.axmin   :=                                                 136
\    500       up.axmax  :=
    1         dp.ax.ini  :=
    1         dp.ax.int  :=
    1         dp.axmin   :=
    \ n.wt1  dp.axmax  :=                                                   141
\    n.wt1    2048  =   if   2000    then
\    n.wt1    1024  =   if   1000    then
\    n.wt1     512  =   if    500    then
\    n.wt1     256  =   if    250    then
\    n.wt1     128  =   if    120    then                                   146
\    n.wt1      64  =   if     80    then
    2  n.power **
    dup       up.axmax   :=
              dp.axmax   :=
  \ i.end   i.int  i.no 1 -    *  -       i.ini :=                          151
  then
  1    ax.shf :=
;
initial.parameter
\ ================================================================        156
: parameter.flag ; \ dummy
```



```
: parameter.change ;
: options.change
  14 foreground
  12 foreground                                                             161
   37 1  goto.xy  ."     i.ini/end=  " \ 54 1 goto.xy ."  "
   37 2  goto.xy  ."     i.interv =  " \ 54 2 goto.xy ."  "
   37 3  goto.xy  ."     i.no     =  " \ 54 3 goto.xy ."  "
\  37 4  goto.xy  ."                =  " \ 54 3 goto.xy ."  "
\  37 5  goto.xy  ."      dig.mid = "  \ 54 3 goto.xy ."  "                 166

   52 1  goto.xy    i.ini     get.val  i.ini     :=
   52 2  goto.xy    i.int     get.val  i.int     :=
   52 3  goto.xy    i.no      get.val  i.no      :=
   52 4  goto.xy    UP.aXmax  get.val  UP.aXmax  :=                         171
   52 5  goto.xy    DP.aXmax  \ 5  0     fix.format
                              get.val  DP.aXmax  :=

\  7  7  goto.xy  ."           Reset options again : "   " <F>"
   int.text
   bell.2sl                                                                 176
\  pckey  drop if myself then
;
0 tmp.v.i :=
: parameter.change
  14 foreground                                                             181
  12 foreground
   7  0  goto.xy  ."                                  "
   7  1  goto.xy  ."    Wlet      =  " \ 24 1 goto.xy ."  "
   7  2  goto.xy  ."    n.wt1     =  " \ 24 2 goto.xy ."  "
   7  3  goto.xy  ."    -> <-     = "  \ 24 3 goto.xy ."  "                 186
   7  4  goto.xy  ."    chirp     = "  \ 24 4 goto.xy ."  "
\  7  5  goto.xy  ."      OPTIONS = "  \ 24 5 goto.xy ."  "

   22 1  goto.xy    wlet      get.str  wlet      ":=
   22 2  goto.xy    n.wt1     get.val  n.wt1      :=                        191
   22 3  goto.xy    isign     get.val  isign      :=
   22 4  goto.xy    i.chirp   get.val  i.chirp   :=
   22 5  goto.xy

  tmp.v.i 999 <>                                                            196
  if
    999    tmp.v.i   :=
    isign  1  =
    if
      30      i.ini      :=                                                 201
      1       i.no       :=
    else
      4       i.ini      :=
      5       i.no       :=
      1000       dp.axmax  :=                                              206
    then
    i.chirp  1  =
    if
      50      i.ini      :=    \ first executed;  small index and low line
        type
```

```
      1       i.no       :=                                                  211
    then
  then
   37 1  goto.xy  ."    i.ini/end = "   i.ini     n.type
   37 2  goto.xy  ."    i.interv  = "   i.int     .
   37 3  goto.xy  ."    i.no      = "   i.no      .                         216

\ 22 5  goto.xy    " OK?"     s.type
\ bell.2sl
\ pckey  drop
\ if                                                                        221
    options.change
\ then
  6  foreground
  7  7  goto.xy  ."            Reset whole again : "   " <F>"  int.text
  bell.2sl                                                                  226
  my.def.colors
  pckey  drop if myself then
;
: parameter.flag.p1
\  nd                                                                       231
  1  1  =       ?drop     \  <-- pcx
  1  1  <>  \  ?drop     \  <-- text
  if
    graphics.display   up
    dir.lee.txt                                                             236
    xeq.flag   " w"  "= if  " def-anaw.pcx" "cat then
    xeq.flag   " r"  "= if  " def-anar.pcx" "cat then
    xeq.flag   " d"  "= if  " def-anad.pcx" "cat then
    defer>  pcx>vup
\ \    {show.wnd.l}                                                         241
    fg.color   foreground
    bg.color   background
    sc
  else
\    sd                                                                     246
    ."                      ----------------------------------------"
       cr
    ."                      | DWT                                  |"
       cr
    ."                      |                                      |"
       cr
    ."                      |                                      |"
       cr
    ."                      |                                      |"       251
       cr
    ."                      ----------------------------------------" \
       cr cr
\    {show.wnd.l}
    bg.color   background
    fg.color   foreground
    sc  \  <-- be aware of the sequence !                                   256
  then

;
```



```
: parameter.flag
  \ 2 1       fix.format                                                    261
  4 0       fix.format
  parameter.flag.p1
  \ {show.wnd.s} {border}
  sc
\ \  {show.wnd.s} {border}                                                 266
  bg.color   background
  14         foreground
  sc

   7  1  goto.xy  ."    Wlet       = "   wlet       s.type                 271
   7  2  goto.xy  ."    n.wt1      = "   n.wt1      .
   7  3  goto.xy  ."    -> <-      = "   isign      .
   7  4  goto.xy  ."    chirp      = "   i.chirp    .

   37 1  goto.xy  ."    i.ini/end = "   i.ini     n.type                   276
   37 2  goto.xy  ."    i.interv  = "   i.int     .
   37 3  goto.xy  ."    i.no      = "   i.no      .
   37 4  goto.xy  ."    UP.Xmax   = "   up.axmax  .
\                                       5  0  fix.format
   37 5  goto.xy  ."    DP.Xmax   = "   dp.axmax  .                          281
\                                       2  1  fix.format

\  7  5  goto.xy  ."       OPTIONS = "  " -->"    s.type
   6  foreground
   7  7  goto.xy  ."               Change DEFAULT  : "   " <F>"              286
      int.text
   bell.2sl
   my.def.colors
  pckey  drop
  if
    parameter.change                                                        291
  then
  bg.color   background
  fg.color   foreground
\  {29.line}
;                                                                           296
: parameter.reset
  isign  1  =
  if
    i.int  0  =
    if                                                                      301
      i.ini   my.power
      2       n.power  i.no  1 -  +  **    i.end :=
      i.end  1 +  1 +                      i.end :=
    else
      i.ini   i.int  i.no 1 -    *  +      i.end :=                         306
      i.end  1 +                           i.end :=
    then
  else  \ ------------------------ \ i : unit base function ;
    i.ini   i.end :=
    i.int   0  =                                                            311
    if
      i.end   my.power
```

```
      2        n.power   i.no 1 -   +   **    1 +      i.ini  :=
    else
      i.end    i.int   i.no 1 -     *   -       i.ini  :=
    then
  then
;
parameter.flag
parameter.reset
\
    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

\ dir.lee.txt        " my-wt.txt" "cat   defer>   load
\
    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

10.       t.dur      :=

token   a          exp.mem>   a
token   b          exp.mem>   b
token   b.p        exp.mem>   b.p
integer scalar i.run
: run
  1   i.run  :=
  i.end    i.ini              \  do  :  ini   end   int
  do
    1   isign    =
    if     \ forward
      2.    Pi *    i   0.9 *   *
      n.wt1 dp.real.flag ramp *     n.wt1 /   sin
      2.    Pi *    i   1.0 *   *
      n.wt1 dp.real.flag ramp *     n.wt1 /   sin
      2.    Pi *    i   1.1 *   *
      n.wt1 dp.real.flag ramp *     n.wt1 /   sin
      +  +   becomes>   B

      i.envelop  0   =
      if
        2.    Pi *    i *   \ t.dur *        \  for sin wave (phase = 2 Pi f
           t)
        n.wt1 dp.real.flag ramp *     n.wt1 /      \
        sin     becomes>   B
      then

      n.wt1 1 +   ramp    becomes>   B.p
      b [ n.wt1 ]     b.p [ n.wt1  1 + ]    :=
      n.wt1   1 +     1
      do    b [ i ]    b.p [ i ] :=        loop

      i.chirp  1   =
      if
      \   2.    Pi *    i *    t.dur *                           \   For
          chirp
      \   n.wt1      dp.real.flag ramp   /                       \
          decreasing
```



```
          \ theta = 2 pi k t^2                 \ f=2 k t
          \ Nyquist or Aliasing
          chirp.spe   11 =
          chirp.spe   12 =   or
          if
            2.    Pi *    1. *                     \ i=1 nyqust     \    For
                chirp
          \ 2.    Pi *   0.02  *                   \ i=1 nyqust     \    For
              chirp
          else
            2.    Pi *    2. *                     \ i>1 aliasing   \    For
                chirp
          then

          \ Linear or Quadratic
          chirp.spe   11 =
          chirp.spe   21 =   or
          if
            4.  /    n.wt1 float /                 \ k linear    \   Nyqust f
                -> /(4n)
            n.wt1 dp.real.flag ramp dup *  *       \ t^2
          else
            6.  /    n.wt1 float dup * /                 \ k quadratic
            n.wt1 dp.real.flag ramp dup dup * *   *      \ t^3
          then

           sin     becomes>   B
           2.    Pi *    i *    t.dur *
           n.wt1  1 + dp.real.flag ramp   /
           sin     becomes>   B.p
      then

    else     \ backward
      n.wt1   dp.real.flag   ramp   becomes>   B
      n.wt1  1 +   dp.real.flag   ramp   becomes>   B.p
      0.d     b           :=
      1.d     b [ i ]     :=
      0.d     b.p [ up.axmax  1 + ] :=
      up.axmax   1 +   up.axmin
      do
        b [ i ]      b.p [ i ] :=
      loop
    then
    alg.flag   1 =
    if
\       nd
      " c:\per\asy\asc\algorith.dat"   defer>   delete
      " c:\per\asy\asc\algorith.dat"   defer>   out>file
    then
    i ."       "  n.type
    "time

\     isign    \    get.h&g.dau
    assign.wlet
    get.h&g
```

```
0  domain.flag  :=
b   isign  1  =  if    forward.wt   else   inverse.wt   then
  becomes> a                                                          416
\ b   n.wt1  isign  wlet      wt     \ NR
alg.flag  1 =
if
  out>file.close   gd
then                                                                  421
i   i.ini  =
if
  up
  horizontal
    axis.fit.off                                                      426
  vertical
    axis.fit.on
  b.p  sub[ up.axmin , up.axmax ax.shf + ]
  []size  ramp  ax.shf - swap  xy.data.fit  drop  drop
  \ b  []size  ramp  swap  xy.data.fit   drop  drop                   431
  up.axmax
  dup            up.ax.end :=
  up.ax.int /    up.ax.no  :=
  \ horizontal    0   up.ax.end      world.set  \ reset up wxmin&max
  wxmin     up.wxmin :=                                             436
  wymin     up.wymin :=
  wxmax     up.wxmax :=
  wymax     up.wymax :=
  xy.axis.plot
  n.wt1  ramp  sub[ up.ax.ini , up.ax.no , up.ax.int ]               441
  b            sub[ up.ax.ini , up.ax.no , up.ax.int ]   i.run
     xydp
  dp
  horizontal
    axis.fit.on
  vertical                                                            446
    axis.fit.on
  \ a sub[ dp.axmin , dp.axmax ax.shf + ]
  \ []size  ramp  ax.shf - swap  xy.data.fit  drop drop
  a sub[ dp.axmin , dp.axmax          ]
  []size  ramp           swap  xy.data.fit  drop drop                 451
  dp.axmax
  dup         dp.ax.end :=
  dp.ax.int /   dp.ax.no  :=
  horizontal    0   dp.ax.end      world.set  \ reset dp wxmin&max
  wxmin     dp.wxmin :=                                             456
  wymin     dp.wymin :=
  wxmax     dp.wxmax :=
  wymax     dp.wymax :=
  xy.axis.plot
  n.wt1  ramp  sub[ dp.ax.ini , dp.ax.no , dp.ax.int ]               461
  a            sub[ dp.ax.ini , dp.ax.no , dp.ax.int ]   i.run
     xydp
else
  up
  up.wxmin  wxmin    :=      \ restore up wx&wy min&max
```



```
    up.wymin  wymin    :=                                             466
    up.wxmax  wxmax    :=
    up.wymax  wymax    :=
    n.wt1  ramp  sub[ up.ax.ini , up.ax.no , up.ax.int ]
    b            sub[ up.ax.ini , up.ax.no , up.ax.int ]   i.run
       xydp
    dp                                                                471
    dp.wxmin  wxmin    :=      \ restore dp wx&wy min&max
    dp.wymin  wymin    :=
    dp.wxmax  wxmax    :=
    dp.wymax  wymax    :=
    n.wt1  ramp  sub[ dp.ax.ini , dp.ax.no , dp.ax.int ]              476
    a            sub[ dp.ax.ini , dp.ax.no , dp.ax.int ]   i.run
       xydp
  then
  "time    "swap
  cr  s.type   cr s.type    ."   "    i    n.type
  i.int  0  =                                                         481
  if
    isign  1  =
    if
      i.ini  my.power
      2  n.power i.run +  **                                          486
      2  n.power i.run 1 - +  **  -
    else
      i.ini  my.power
      2  n.power i.run 1 -  -   **
      2  n.power i.run      -   **  -  neg                           491
    then
    i.int :=
    i.int
    0  i.int  :=
  else                                                                496
    i.int
  then
  i.run 1 +  i.run :=
 +loop
;                                                                     501
\ gd  sc  "time  s.type
gd  sc  "time  s.type

\
   ------------------------------------------------------------------------

run                                                                   506
\
   ------------------------------------------------------------------------

: inv1
  0.  b :=   1.  b [ 5 ]  :=
  b  inverse.wt
     gd hp                                                            511
     up 1 yap
     swt.t  becomes> b
  b  forward.wt
```

```
      sub[ 1 , p.pnts ]
      dp 1 yap                                                    516
\   MY.PAUSE
  0.  b :=  1.  b [ 16  2 n.power 1 - ** + ]  :=
  b  inverse.wt
      sub[ 1 , p.pnts ]
      gd hp 1 yap                                                 521
;
: inv2
  0.  b :=  1.  b [ 8   2 n.power 2 - ** + ]  :=
  b  inverse.wt
      sub[ 1 , p.pnts ]                                           526
      2 ydp

  0.  b :=  1.  b [ 4   2 n.power 3 - ** + ]  :=
  b  inverse.wt
      sub[ 1 , p.pnts ]                                           531
      3 ydp
;
: inv3
  0.  b :=  1.  b [ 2   2 n.power 4 - ** + ]  :=
  b  inverse.wt                                                   536
      sub[ 1 , p.pnts ]
      5 ydp
;

: inv4                                                            541
  0.  b :=  1.    b [ 24 ]  :=
  \ b [ 5 ]  :=
  b  inverse.wt
  gd hp
      up 1 yap                                                    546
      swt.t  becomes> b
  b  forward.wt
      sub[ 1 , p.pnts ]
      dp 1 yap
  \ MY.PAUSE                                                      551
  0.  b :=  1.  b [ 16  2 n.power 1 - ** + ]  :=
  b  inverse.wt
      sub[ 1 , p.pnts ]
      gd hp 1 yap
;                                                                 556
: inv5
  0.  b :=  1.  b [ 8   2 n.power 2 - ** + ]  :=
  b  inverse.wt
      sub[ 1 , p.pnts ]
      2 ydp                                                       561
  0.  b :=  1.  b [ 4   2 n.power 3 - ** + ]  :=
  b  inverse.wt
      sub[ 1 , p.pnts ]
      3 ydp
;                                                                 566
: inv6
  0.  b :=  1.  b [ 2   2 n.power 4 - ** + ]  :=
  b  inverse.wt
```



```
      sub[ 1 , p.pnts ]
      5 ydp                                                       571
;
integer scalar i.ele  scalar i.lin  scalar num.dig
  12  i.ele  :=
  1   i.lin  :=
: lab.spe                                                         576
  " Spec:"   wlet "cat  " ,"   "cat
  "  JWP Level "  "cat  jwp.level 0 n>s  "cat  "  at location " "cat
  i.ele  0 n>s  "cat  "  [WB<-("  "cat
  \ 2 jwp.level 1 + **  num.dig  n>s  "cat  " )->WP]" "cat
  2 jwp.level 1 + **  0  n>s  "cat  " )->WP]" "cat                581
  normal.coords  0.5  0.03  position  centered.label
  1.  1.  position    world.coords
;
: lab.x
  normal.coords     position  centered.label                      586
  1.  1.  position    world.coords
;

dir.asy.sys " 123io.sov" "cat defer> load.overlay
26  0   29  79  window  hp.menu.wnd                               591
-1   isign := \ ." <- or -> :"
: set.let.p1
  hp.menu.wnd \  {border}
  2   0  goto.xy
      ." Wavelet (" " on22a/s, bo220/d, so0/d , le, me" s.type ." ):"   596
      wlet  s.type
  60  0  goto.xy    2  0 fix.format
      ." <- or -> :"   isign  n.type
      1 0 fix.format
  2   1  goto.xy                                                  601
      ." WP(1) / WB(0):"   wp.flag 1 = if " WP(1)" else " WB(0)"  then
      s.type   wp.flag  n.type
  30  1  goto.xy
      ." JWP Level:"   jwp.level   n.type
  60  1  goto.xy     4 0 fix.format                               606
      ." #.pnts:"          n.wt1  n.type
  2   2  goto.xy     2 0 fix.format
      ." .Pcx: "                  file.ext  s.type
  30  2  goto.xy
      ." 123->"           wlet " .wks" "cat  s.type               611
  60  2  goto.xy
      ." File.#:"                 file.no   n.type
;
: set.let
  hp.menu.wnd \  {border}                                         616
  sc
  set.let.p1
  2   0  goto.xy
      ." Wavelet (" " on22a/s, bo220/d, so0/d , le, me" s.type ." ):"
      b.t                                                         621
      wlet  get.str  wlet ":="
      b.t
  60  0  goto.xy    2  0 fix.format
```

```
      \ ." <- or -> :"              -1  get.val isign :=
      ." <- or -> :"      isign get.val isign :=                    626
      1 0 fix.format
  2   1  goto.xy
      ." WP(1) / WB(0):"   wp.flag 1 = if " WP(1)" else " WB(0)"  then
      s.type   wp.flag  get.val  wp.flag :=
  30  1  goto.xy                                                    631
      ." JWP Level:"   jwp.level  get.val  jwp.level :=
  60  1  goto.xy     4 0 fix.format
      ." #.pnts:"           n.wt1  get.val  n.wt1 :=
  2   2  goto.xy     2 0 fix.format
      ." .Pcx: "                  file.ext  get.str file.ext ":=    636
  30  2  goto.xy
      ." 123->"          wlet " .wks" "cat  get.str tmp.s  ":=
  60  2  goto.xy
      ." File.#:"                 file.no   get.val file.no   :=
  dir.lee.asc   tmp.s  "cat   123.file.name  ":=                    641
  isign 1 =
  if
    \ n.wt1  dp.real ramp  becomes> b
    \ 0   b  :=
    cr                                                              646
    " Has B been set?!"  s.type
  then
\ 123.file.name     defer>  123file.create
\ release.overlay
\ previous.window                                                   651
;

: set.let.res
  {hp.wnd}
  sc                                                                656
  cr  ." Wavelet:(" " on22a/s, bo220/d, so0/d , le, me" s.type ." )"
      wlet  get.str  wlet ":=
  1 0 fix.format
  cr  ." WP (1) or WB (0) :"  wp.flag 1 = if " WP(1)" else " WB(0)"
     then
      s.type   wp.flag  get.val  wp.flag :=                         661
  cr  ." JWP Level :"  jwp.level  get.val  jwp.level :=
  4 0 fix.format
  cr  ." Number of Points:" n.wt1  get.val  n.wt1 :=
  2 0 fix.format
  cr  ." Inverse or Forward(1):"  -1  get.val isign :=              666
  cr  ." File Extention for PCX: " file.ext  get.str file.ext ":=
  cr  ." 123 File name: " wlet " .wks" "cat  get.str tmp.s  ":=
  cr  ." File.no: "               file.no   get.val file.no   :=
  dir.lee.asc   tmp.s  "cat   123.file.name  ":=
  isign 1 =                                                         671
  if
    \ n.wt1  dp.real ramp  becomes> b
    \ 0   b  :=
    " Has B been set?!"  s.type
  then                                                              676
  123.file.name     defer>  123file.create
  release.overlay
```



```
  previous.window
;
release.overlay                                                     681

: lee
  isign  -1  =
  if
    n.wt1  dp.real ramp  becomes> b                                 686
    1  0 fix.format
    0.  b  :=
    cr ." JWP Level(" wlet s.type ." ):"  jwp.level  get.val   jwp.level
       :=
\
   ------------------------------------------------------------------------

    cr ." Element "                                                 691
    wp.flag 1 =
    if
      " (WP: located at level "  jwp.level 0 n>s "cat  " )" "cat s.type.3
    else
      " (WB: min. level at "  jwp.level 0 n>s "cat  " )" "cat s.type.3    696
    then
    ."  (Phi<-"
    1  0 fix.format
    jwp.level  9 >=
    if                          4                                   701
    else
      jwp.level  6 >=
      if                        3
      else
        jwp.level  3 >=                                             706
        if                      2
        else                    1
        then
      then
    then                                                            711
    dup  num.dig :=    0  fix.format
    2 jwp.level     ** n.type ." |->Psi:[WB"
    \ ------------------------------------- -
    wp.flag 1 =
    if                                                              716
      ." <-"
      1  0 fix.format
      jwp.level  9 >=
      if                          4
      else                                                          721
        jwp.level  6 >=
        if                        3
        else
          jwp.level  3 >=
          if                      2                                 726
          else                    1
          then
        then
      then
```

```
      dup  num.dig :=    0  fix.format                                    731
      2 jwp.level 1 + ** n.type ." |->WP]): "
    else
      ." ]): "
    then
\                                                                         736
   ------------------------------------------------------------------------

\     cr ." Element (WB<-"
\     1  0 fix.format
\     jwp.level  9 >=
\     if                        4
\     else                                                                741
\       jwp.level  6 >=
\       if                      3
\       else
\         jwp.level  3 >=
\         if                    2                                         746
\         else                  1
\         then
\       then
\     then
\     dup  num.dig :=    0  fix.format                                    751
\     2 jwp.level 1 + ** n.type ." |->WP):"
    3 0 fix.format
    i.ele get.val i.ele :=    1 0 fix.format
    cr ." Clear (1) or Overlap:"     i.lin      get.val   i.lin     :=
    1.  b [ i.ele ] :=                                                    756
    b  inverse.wt
    wp.flag 1 =
    if
      drop  swp.t
    else                                                                  761
      drop  swt.t
    then
  else
    {hp.wnd}  " Have you set B (in --> mode)?" s.type  \ my.pause
    cr ." Choose array for Forward Transform "                            766
    " 0:default B, 1:WB.t, 2:WP.t" s.type.3
    0 get.val
    case
      1  of   swt.t  endof
      2  of   swp.t  endof                                                771
      0  of   b      endof
    endcase
    previous.window
    forward.wt      \ always d.t for WB and WP -- set Wp.flag
  then                                                                    776
  n.power  10 = if  sub[ 1 , 1000 ] then
  n.power   9 = if  sub[ 1 ,  500 ] then
  n.power   8 = if  sub[ 1 ,  250 ] then
  n.power   7 = if  sub[ 1 ,  120 ] then
  n.power   6 = if  sub[ 1 ,   70 ] then                                  781
  i.lin
  i.lin     1 =
```



```
  if  yap   lab.spe   else  ydp  then
  10 5 fix.format
;                                                                         786
10 5 fix.format
: NOR.TEST
  hp
  b  forward.wt  1 yap
  norm.wp.best                                                            791
  norm.l 1 yap  my.pause
  norm.v 2 yap
;
: plot
\  jwp.level 0 =                                                        796
\  if
\    awp.t xsect[ n.power 1 + , ! ]  tmp.v.i yap
\  else
  n.wt1  my.power
  \ jwp.level tmp.v.i :=                                                  801
  jwp.level 1 - tmp.v.i :=
  hp
  begin
    tmp.v.i 1 +  tmp.v.i :=
\ \\    tmp.v.i   1 =                                                     806
    tmp.v.i   0 =
    if
      awp.t xsect[ n.power 1 + , ! ]
    else
      awp.t xsect[ tmp.v.i , ! ]                                          811
    then
    tmp.v.i
    tmp.v.i  jwp.level =
    if
      yap                                                                 816
    else
      ydp
    then
    hp   \   previous.window
    \   tmp.v.i  n.type                                                  821
    normal.coords
    tmp.v.i   0   n>s    tmp.v.i  20. /   0.05  position
    tmp.v.i line.type label
    tmp.v.i 1 +  20. /   0.05  position
    world.coords                                                          826
    my.pause
    \ previous.window
    tmp.v.i  n.power  =
  until
;                                                                         831
: get.lab
  wlet tmp.s.u ":="
  tmp.s.u "upper "drop
  normal.coords  .5  .05  position
  tmp.s.u                                                                 836
  centered.label
  world.coords
```

```
;

sd                                                                    841
cdtNow load LLet-DnR.asy \
cdtNow load LLet-Blo.asy \
cdtNow load LLet-Pha.asy \
cdtNow load LLet-Nor.asy \
cdtNow load LLet-Ent.asy \                                            846
  \ \ cdtNow   load LLet-Lev.txt \
cdtNow load LLet-WPM.asy \
cdtNow load LLet-Act.asy \
```

LLet-Act.asy

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```
: LLet-Act.asy ; \ %----- Asyst Prog
\ : LLet-Ba2.asy ; \ : LLet-Bat.asy ;

1 file.no :=
1 gp.flag :=
\ " abc" file.ext ":=
" pcx" file.ext ":= \ for imaging files

3 string act.flag.str
integer scalar act.flag   scalar plot.gp

\ : action
\   act.flag
\   case
\   0  of  dec&rec     endof
\   1  of  dec&rec     endof
\   2  of  m0.s.phase  endof
\   3  of  norm.bat    endof
\   4  of  ent.bat    endof
\ \ 4  of  \ cr  ." #.weight "   #.wei   get.val  #.wei   :=
\ \        cr  ." array?"
\ \        cr  ." s.freq   "   s.freq  get.val  s.freq  :=
\ \        cr  ." filter   "   tmp.v.i get.val  tmp.v.i :=
\ \        s.freq  tmp.v.i  fre.mod
\ \                endof
\   endcase
\ ;
: action
  act.flag.str " D" "=
  if
    dec&rec
  then
  act.flag.str " P" "=
  if
    m0.s.phase
  then
  act.flag.str " N" "=
  if
    norm.bat
  then
  act.flag.str " E" "=
  if
    ent.bat
  then
;

: ACT.me.p1
  " me"    wlet ":=  action
;
: ACT.me
  dir.lee.asc  " me"    "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
```



```
  ACT.me.p1
;
: ACT.le.p1
  " le"    wlet ":=  action
;
: ACT.le
  dir.lee.asc  " le"    "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.le.p1
;
: ACT.so.p1
  " so0"   wlet ":=  action
  " so4"   wlet ":=  action
;
: ACT.so
  dir.lee.asc  " so"     "cat  " .wks" "cat   123.file.name  ":=
  ACT.so.p1
;
: ACT.tmp
  dir.lee.asc  " 123"  "cat  " .wks" "cat   123.file.name  ":=
\  " so0"   wlet ":=  5   i.ele :=  action
\  " so0"   wlet ":=  384 i.ele := action
\ " bo33d"   wlet ":=  5   i.ele :=  action
\ " bo33d"   wlet ":=  384 i.ele :=  action
  " on22a"   wlet ":= action
;
: ACT.bo1.p1
\   " bo110" wlet ":=  action
\   " bo11d" wlet ":=  action
\   " bo130" wlet ":=  action
\   " bo13d" wlet ":=  action
\   " bo150" wlet ":=  action
\   " bo15d" wlet ":=  action
  " bo110" wlet ":=  action
  " bo130" wlet ":=  action
  " bo150" wlet ":=  action
  " bo11d" wlet ":=  action
  " bo13d" wlet ":=  action
  " bo15d" wlet ":=  action
;
: ACT.bo1
  dir.lee.asc  " bo1" "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.bo1.p1
;
: ACT.bo2.p1
\   " bo220" wlet ":=  action
\   " bo22d" wlet ":=  action
\   " bo240" wlet ":=  action
\   " bo24d" wlet ":=  action
\   " bo260" wlet ":=  action
\   " bo26d" wlet ":=  action
\   " bo280" wlet ":=  action
\   " bo28d" wlet ":=  action
  " bo220" wlet ":=  action
```

```
  " bo240" wlet ":=  action
  " bo260" wlet ":=  action
  " bo280" wlet ":=  action
  " bo22d" wlet ":=  action
  " bo24d" wlet ":=  action
  " bo26d" wlet ":=  action
  " bo28d" wlet ":=  action
;
: ACT.bo2
  dir.lee.asc  " bo2" "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.bo2.p1
;
: ACT.bo3.p1
\   " bo310" wlet ":=  action
\   " bo31d" wlet ":=  action
\   " bo330" wlet ":=  action
\   " bo33d" wlet ":=  action
\   " bo350" wlet ":=  action
\   " bo35d" wlet ":=  action
\   " bo370" wlet ":=  action
\   " bo37d" wlet ":=  action
\   " bo390" wlet ":=  action
\   " bo39d" wlet ":=  action
  " bo310" wlet ":=  action
  " bo330" wlet ":=  action
  " bo350" wlet ":=  action
  " bo370" wlet ":=  action
  " bo390" wlet ":=  action
  " bo31d" wlet ":=  action
  " bo33d" wlet ":=  action
  " bo35d" wlet ":=  action
  " bo37d" wlet ":=  action
  " bo39d" wlet ":=  action
;
: ACT.bo3
  dir.lee.asc  " bo3" "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.bo3.p1
;
: ACT.onc.p1
  " on11c" wlet ":=  action
  " on22c" wlet ":=  action
  " on33c" wlet ":=  action
  " on44c" wlet ":=  action
  " on55c" wlet ":=  action
;
: ACT.onc
  dir.lee.asc  " onc" "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.onc.p1
;
: ACT.ona.p1
  " on22a" wlet ":=  action
  " on33a" wlet ":=  action
```



```
  " on44a" wlet ":=  action
  " on55a" wlet ":=  action
  " on66a" wlet ":=  action
  " on77a" wlet ":=  action
  " on88a" wlet ":=  action
  " on99a" wlet ":=  action
  " on00a" wlet ":=  action
;
: ACT.ona
  dir.lee.asc  " ona" "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.ona.p1
;
: ACT.ons.p1
  " on44s" wlet ":=  action
  " on55s" wlet ":=  action
  " on66s" wlet ":=  action
  " on77s" wlet ":=  action
  " on88s" wlet ":=  action
  " on99s" wlet ":=  action
  " on00s" wlet ":=  action
;
: ACT.ons
  dir.lee.asc  " ons" "cat  " .wks" "cat   123.file.name  ":=
  1  file.no  :=
  ACT.ons.p1
;

3  0   24  79   window gd.txt.wnd
6.0   p.b.e :=
6.0   t.w :=
: set.cwt ;
\ : for.norm&ent
\   5   4  goto.xy
\            \ ." Now.file (name.ext) ?"  now.file  get.str  now.file
   ":=
\             ." Now.file (name.ext):"  now.file  get.str  now.file ":=
\   5   5  goto.xy    8 4 fix.format
\ \           ." Sampling freq KEEP :" s.freq.keep  get.val
   s.freq.keep :=
\             ." Sampling freq -- original rate (s.freq.keep):"
\             s.freq.keep  get.val  s.freq.keep :=
\          2 0 fix.format
\   5   6  goto.xy
\             ." array index Inc :" i.inc  get.val  i.inc :=
\   5   7  goto.xy    8 4 fix.format
\             ." Norm.keep.p.BEST :"
\          7 4 fix.format
\          norm.keep.p.best get.val norm.keep.p.best :=
\   5   8  goto.xy
\             ." abs.flag for L**1 :"  abs.flag  get.val abs.flag :=
\          2 0 fix.format
\   5   9  goto.xy
\             ." filter.flag :"  0  get.val  filter.flag :=
\          1 filter.flag =
```

```
\           if                                                                  216
\    5    11 goto.xy
\                ." Pass band end (Hz) ?"  p.b.e get.val      p.b.e :=
\    5    12 goto.xy
\                ." Transition width (Hz) ?" t.w get.val  t.w    :=
\           then                                                                221
\    5    13 goto.xy
\              ." Section level :" n.wt1 my.power n.power  get.val
    sec.level :=
\           set.let
\    5    15 goto.xy
\           set.123                                                             226
\ ;
: for.norm&ent \ batch display of parameters
  5  4  goto.xy
           \ ." Now.file (name.ext) ?"  now.file s.type \ get.str
             now.file ":=
            ." Now.file (name.ext):"  now.file s.type \ get.str                231
             now.file ":=
  5  5  goto.xy     8 4 fix.format
\           ." Sampling freq KEEP :" s.freq.keep  n.type \ get.val
    s.freq.keep :=
           ." Sampling freq -- original rate (s.freq.keep):"
           s.freq.keep  n.type \ get.val  s.freq.keep :=
       2 0 fix.format                                                          236
  5  6  goto.xy
           ." array index Inc :" i.inc  n.type \ get.val  i.inc :=
  5  7  goto.xy     8 4 fix.format
           ." Norm.keep.p.BEST :"
       7 4 fix.format                                                          241
       norm.keep.p.best n.type \ get.val norm.keep.p.best :=
  5  8  goto.xy
           ." abs.flag for L**1 :"  abs.flag n.type \ get.val abs.flag
             :=
       2 0 fix.format
  5  9  goto.xy                                                              246
           ." filter.flag :" filter.flag n.type \ get.val  filter.flag
             :=
       1 filter.flag =
       if
  5  11 goto.xy
            ." Pass band end (Hz) ?"  p.b.e n.type \ get.val      p.b.e     251
              :=
  5  12 goto.xy
            ." Transition width (Hz) ?" t.w n.type \ get.val  t.w    :=
       then
  5  13 goto.xy
           ." Section level :" n.wt1 my.power n.power                         256
           sec.level :=
           sec.level n.type
  5  14 goto.xy 4 0 fix.format
  act.flag.str "upper " E" "=
  if                                                                          261
    ." #.div:" #.div n.type \ get.val  #.div :=
  then
```



```
  set.let
  5  15 goto.xy
  set.123                                                                     266
;
: for.norm&ent.get \ interactive input
  5  4  goto.xy
           \ ." Now.file (name.ext) ?"  now.file  get.str  now.file ":=
            ." Now.file (name.ext):"  now.file  get.str  now.file ":=       271
  5  5  goto.xy     8 4 fix.format
\           ." Sampling freq KEEP :" s.freq.keep  get.val  s.freq.keep
    :=
           ." Sampling freq -- original rate (s.freq.keep):"
           s.freq.keep  get.val  s.freq.keep :=
       2 0 fix.format                                                         276
  5  6  goto.xy
           ." array index Inc :" i.inc  get.val  i.inc :=
  5  7  goto.xy     8 4 fix.format
           ." Norm.keep.p.BEST :"
       7 4 fix.format                                                         281
       norm.keep.p.best get.val norm.keep.p.best :=
  5  8  goto.xy
           ." abs.flag for L**1 :"  abs.flag  get.val abs.flag :=
       2 0 fix.format
  5  9  goto.xy                                                             286
           ." filter.flag :"  0  get.val  filter.flag :=
       1 filter.flag =
       if
  5  11 goto.xy
            ." Pass band end (Hz) ?"  p.b.e get.val      p.b.e :=          291
  5  12 goto.xy
            ." Transition width (Hz) ?" t.w get.val  t.w    :=
       then
  5  13 goto.xy
           ." Section level :" n.wt1 my.power n.power  get.val               296
             sec.level :=
  5  14 goto.xy 4 0 fix.format
  act.flag.str "upper " E" "=
  if
    ." #.div:" #.div get.val  #.div :=
  then                                                                       301
  set.let
  5  15 goto.xy
  set.123
;
\ : for.norm&ent.res                                                         306
\           cr ." Now.file (name.ext):"  now.file  get.str  now.file ":=
\              8 4 fix.format
\           cr ." Sampling freq -- original rate (s.freq.keep):"
\              s.freq.keep  get.val  s.freq.keep :=
\           cr ." Norm.keep.p.BEST?"                                         311
\           7 4 fix.format
\           norm.keep.p.best get.val norm.keep.p.best :=
\           cr ." abs.flag for L**1"  abs.flag  get.val abs.flag :=
\           2 0 fix.format
\           cr ." Index Interval for Sub-sampling:" 4  get.val  i.inc :=    316
```

```
\          cr ." filter.flag?"  0  get.val  filter.flag :=
\          1 filter.flag =
\          if
\            cr ." Pass band end (Hz)?" 6 get.val     p.b.e :=
\            cr ." Transition width (Hz)?" 6 get.val  t.w   :=          321
\          then
\          cr ." Section level:" n.wt1 my.power n.power  get.val
   sec.level :=
\          set.let
\          set.123
\ ;                                                                   326
1  i.beg :=
4  i.inc :=
\ : set.act
\   gd
\   gd.txt.wnd    {border}                                            331
\   3   3   goto.xy
\      ." 1:Decomp&Recon, 2:M0.phase, 3:Norm.wt, 4:Entropy, 5:CWT --"
\   act.flag  get.val  act.flag :=
\   act.flag
\   case                                                              336
\     3  of  for.norm&ent  endof
\     4  of  for.norm&ent
\            \         5   14 goto.xy
\          4 0 fix.format
\          cr ." #.div:"  #.div  get.val  #.div :=                    341
\                         endof
\     5  of
\          5   4  goto.xy
\             ." Now.file (name.ext):"  now.file  get.str  now.file ":=
\          5   5  goto.xy                                             346
\          4 0 fix.format
\          n.wt1  my.power
\             ." Number of points of wavelet (n.wt1):"
\             2 n.power **  get.val  n.wt1 :=
\          5   6  goto.xy    8 4 fix.format                          351
\             ." Sampling freq -- original rate (s.freq.keep):"
\             s.freq.keep  get.val  s.freq.keep :=
\          5   7  goto.xy
\          2 0 fix.format
\             ." Index Interval for Sub-sampling:" i.inc  get.val     356
   i.inc :=
\          5   8  goto.xy
\             ." Index of first point of array" i.beg  get.val  i.beg
   :=
\             \ ." Index of first point of array" i.beg  get.val  i.beg
    :=
\
\          cr set.cwt                                                 361
\          endof
\   endcase
\ ;
: set.act
  gd                                                                  366
  gd.txt.wnd    {border}
```



```
  3   2   goto.xy
  ." D:Dec&Rec, P:Phase.M0s, N:Norm.wt, E:Entropy, C:CWT, W:WCoh :: "
  act.flag.str s.type \ get.str  act.flag.str ":=
  \ act.flag.str get.str  act.flag.str ":=                            371
  cr
  act.flag.str "upper " N" "=
  if
    for.norm&ent
  then                                                                376
  act.flag.str "upper " E" "=
  if
    for.norm&ent
\     5  14 goto.xy 4 0 fix.format
\     ." #.div:"  #.div get.val  #.div :=                              381
  then
\   act.flag.str "upper " C" "=
\   if
\     cwt.56
\     for.case5&6                                                     386
\     cr set.cwt
\     cr new.pause
\     cwt
\   then
\   act.flag.str "upper " W" "=                                       391
\   if
\     cwt.56
\     for.case5&6
\     cr set.cwt
\     5  19 goto.xy                                                   396
\     \ cr
\     ." Real or Imag or Comp:" rea.or.com s.type \ get.str "upper
    rea.or.com ":=
\     cr new.pause
\     cr set.123
\     10 5 fix.format                                                 401
\     run.coh
\   then
;
: set.act.res
  cr   ." 1:Decomp&Recon, 2:M0.phase, 3:Norm.wt, 4:Entropy, 5:CWT --"  406
  5  get.val  act.flag :=
  act.flag
  case
    3  of  for.norm&ent  endof
    4  of  for.norm&ent                                               411
           4 0 fix.format
        cr ." #.div:"  #.div  get.val  #.div :=
                       endof
    5  of
          cr ." Now.file (name.ext):"  now.file  get.str  now.file ":=  416
          4 0 fix.format
          n.wt1  my.power
          cr ." Number of points of wavelet (n.wt1):"
          2 n.power **  get.val  n.wt1 :=
          8 4 fix.format                                              421
```

```
          cr ." Sampling freq -- original rate (s.freq.keep):"
            s.freq.keep  get.val  s.freq.keep :=
          2 0 fix.format
          cr ." Index Interval for Sub-sampling:" i.inc  get.val  i.inc
            :=
          cr ." Index of first point of array" i.beg  get.val  i.beg :=   426
    \     cr ." Number of freq resolution #.fre"  1  get.val  #.fre :=
    \     cr ." Section level:" n.wt1 my.power n.power  get.val
        sec.level :=
    \     set.let
    \     set.123
    \   cr ." #.div:"  #.div  get.val  #.div :=                          431
                        endof

  endcase
  \ LEE
;                                                                        436

: app.p.s
  dir.lee.asc  now.file  "cat  ftoa.bat
  sub[ 1 , 2 n.power ** , i.inc ]
  2 n.power **  999  " x"  my.p.s                                        441
  dup  catenate
  norm.wt&wp
  \  8 file.no  :=
  " power.s"  123.ary.s "[ 1 ]  ":=
  to.123                                                                 446
;

integer scalar gp.fac

: copy.pcx                                                               451
  0  tmp.v.i :=
  begin
    tmp.v.i  1 + tmp.v.i :=
    cdaNow  tmp.v.i 0 n>s  " ."  "cat file.ext "cat       defer>  copy
            tmp.v.i 0 n>s  " .g" "cat plot.gp  0 n>s "cat defer>  to      456
    tmp.v.i  file.no 1 -  =
  until
    cdaNow  " *."  file.ext "cat                          defer>  delete
;
\ : act.all.1                                                            461
\ \   cr ." Now file (b0w6020.2)"  " b0w6020.4"  get.str  now.file ":=
\   cr ." Now file (b0w6020.2)"  now.file  get.str  now.file ":=
\   cr ." 123 file name : "  " 123"  get.str
\   dir.lee.asc  "swap  "cat  " .wks" "cat  123.file.name  ":=
\   cr ." Group factor (10 cols --> 1) : "  1  get.val  gp.fac  :=       466
\   cr ." Section level for norm:"  n.power  get.val  sec.level :=
\
\   1            file.no  :=
\   10 gp.fac *  col.inc  :=
\                                                                        471
\   1  gp.fac *  gp.flag  :=
\   1  plot.gp  :=
\   1  file.no  :=
```



```
\       act.le.p1
\       act.me.p1                                                        476
\       wp.flag
\       0  wp.flag :=
\       act.so.p1
\       act.flag  4  <>
\       if                                                               481
\         to.123.1  \ additional col
\         to.123.2  \ additional col
\         copy.pcx
\         8 file.no :=
\         app.p.s                                                        486
\       else
\         copy.pcx
\       then
\         wp.flag :=
\ ;                                                                      491
\ ================================================================
: ACT.Gp.Ini \  <-- Part of act.all.1
  \ cr ." Now file (b0w6020.2)"  now.file  get.str  now.file ":=
                  " b0w6020.2"                          now.file ":=
  \ cr ." Group factor (10 cols --> 1) : "  1  get.val  gp.fac  :=       496
                                              1          gp.fac  :=
  \ cr ." Section level for norm:" n.wt1 my.power n.power get.val
     sec.level :=
                                    n.wt1 my.power n.power
                                       sec.level :=
  1            file.no  :=
  10 gp.fac *  col.inc  :=                                               501
  \
  1  gp.fac *  gp.flag  :=
  1  plot.gp  :=
  1  file.no  :=
  \   wp.flag                                                            506
  \   0  wp.flag :=
  \   wp.flag :=
;
: ACT.Gp.LMS
  " le"    wlet ":=  action                                              511
  " me"    wlet ":=  action
  " so0"   wlet ":=  action
  " so4"   wlet ":=  action
  copy.pcx
;                                                                        516
: ACT.Gp.onC
  " on11c" wlet ":=  action
  " on22c" wlet ":=  action
  " on33c" wlet ":=  action
  " on44c" wlet ":=  action                                              521
  " on55c" wlet ":=  action
  copy.pcx
;
: ACT.Gp.onA1
  " on22a" wlet ":=  action                                              526
  " on33a" wlet ":=  action
```

```
  " on44a" wlet ":=  action
  " on55a" wlet ":=  action
  " on66a" wlet ":=  action
  copy.pcx                                                    531
;
: ACT.Gp.onA2
  " on77a" wlet ":=  action
  " on88a" wlet ":=  action
  " on99a" wlet ":=  action                                   536
  " on00a" wlet ":=  action
  copy.pcx
;
: ACT.Gp.onS1
  " on44s" wlet ":=  action                                   541
  " on55s" wlet ":=  action
  " on66s" wlet ":=  action
  " on77s" wlet ":=  action
  copy.pcx
;                                                             546
: ACT.Gp.onS2
  " on88s" wlet ":=  action
  " on99s" wlet ":=  action
  " on00s" wlet ":=  action
  copy.pcx                                                    551
;
: ACT.Gp.bo10
  " bo110" wlet ":=  action
  " bo130" wlet ":=  action
  " bo150" wlet ":=  action                                   556
  copy.pcx
;
: ACT.Gp.bo1D
  " bo11d" wlet ":=  action
  " bo13d" wlet ":=  action                                   561
  " bo15d" wlet ":=  action
  copy.pcx
;
: ACT.Gp.bo20
  " bo220" wlet ":=  action                                   566
  " bo240" wlet ":=  action
  " bo260" wlet ":=  action
  " bo280" wlet ":=  action
  copy.pcx
;                                                             571
: ACT.Gp.bo2D
  " bo22d" wlet ":=  action
  " bo24d" wlet ":=  action
  " bo26d" wlet ":=  action
  " bo28d" wlet ":=  action                                   576
  copy.pcx
;
: ACT.Gp.bo30
  " bo310" wlet ":=  action
  " bo330" wlet ":=  action                                   581
  " bo350" wlet ":=  action
```



```
  " bo370" wlet ":=  action
  " bo390" wlet ":=  action
  copy.pcx
;                                                             586
: ACT.Gp.bo3D
  " bo31d" wlet ":=  action
  " bo33d" wlet ":=  action
  " bo35d" wlet ":=  action
  " bo37d" wlet ":=  action                                   591
  " bo39d" wlet ":=  action
  copy.pcx
;

10 5 fix.format                                               596
\ ================================================================
: act.all.1
\ \    cr ." Now file (b0w6020.2)"  " b0w6020.4"  get.str  now.file ":=
\   cr ." Now file (b0w6020.2)"  now.file  get.str  now.file ":=
\   cr ." 123 file name : (123.wks -- No Path)"  " 123.wks"  get.str   601
\   dir.lee.asc  "swap  "cat  123.file.name  ":=
  cr ." Now file (b0w6020.2)"  now.file  get.str  now.file ":=
  cr ." 123 file name (G:\path\123.wks -- With path): "  123.file.name
     get.str
  123.file.name  ":=
                                                              606
  cr ." Group factor (10 cols --> 1) : "  1  get.val  gp.fac  :=
  \ cr ." Section level for norm:"  n.power  get.val  sec.level :=
  cr ." Section level for norm:" n.wt1 my.power n.power get.val
     sec.level :=

  1             file.no  :=                                   611
  10 gp.fac *  col.inc  :=

  1  gp.fac *  gp.flag  :=
  1  plot.gp  :=
  1  file.no  :=                                              616
     act.le.p1
     act.me.p1
     wp.flag
     0  wp.flag :=
     act.so.p1                                                621
  \ ---------------------------------------- ■
\      act.flag  4  <>
\      if
\        to.123.1  \ additional col
\        to.123.2  \ additional col                           626
\        copy.pcx
\        8 file.no :=
\        app.p.s
\      else
\        copy.pcx                                             631
\      then
\        wp.flag :=
  \  act.flag  4  <>
     act.flag.str " E"  "=
```

```
      if                                                          636
        copy.pcx
      else
        to.123.1   \ additional col
        to.123.2   \ additional col
        copy.pcx                                                  641
        8 file.no :=
        app.p.s
      then
        wp.flag :=
;                                                                 646
: act.all.2
  2  gp.fac *  gp.flag  :=
  2  plot.gp   :=

  1  file.no   :=                                                 651
     act.ona.p1
     copy.pcx
;
: act.all.3
  3  gp.fac *  gp.flag  :=                                        656
  3  plot.gp   :=
  1  file.no   :=
     act.ons.p1
     copy.pcx
;                                                                 661
: act.all.4
  4  gp.fac *  gp.flag  :=
  4  plot.gp   :=
  1  file.no   :=
     act.onc.p1                                                   666
     copy.pcx
;
: act.all.5
  wp.flag
  5  gp.fac *  gp.flag  :=                                        671
  5  plot.gp   :=
  1  file.no   :=    0 wp.flag :=
     act.bo1.p1
     wp.flag :=
     copy.pcx                                                     676
;
: act.all.6
  wp.flag
  6  gp.fac *  gp.flag  :=
  6  plot.gp   :=                                                 681
  1  file.no   :=    0 wp.flag :=
     act.bo2.p1
     wp.flag :=
     copy.pcx
;                                                                 686
: act.all.7
  wp.flag
  7  gp.fac *  gp.flag  :=
  7  plot.gp   :=
```



```
  1  file.no   :=    0 wp.flag :=                                 691
     act.bo3.p1
     wp.flag :=
     copy.pcx
;
                                                                  696
: act.all
  act.all.1
  act.all.2
  act.all.3
  act.all.4                                                       701
  act.all.5
  act.all.6
  act.all.7
;
10 5 fix.format                                                   706

\
\ " b0w6020.4"      now.file   ":= \ 200Hz   4Ch
\ " f0w6020.2"      now.file   ":= \ 40Hz    2Ch
\ " chirp-al.dat"   now.file   ":= \ --Hz    1Ch                  711

.....................................................................................................
```

LLet-Blo.asy

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```
: LLet-Blo.asy ; \ %----- Asyst Prog                                          1
\ Be sure to use PSI to blow up.
\ Since it is already in the psi region

\ 1        file.no     :=
\ " pcx"   file.ext   ":=                                                    6
" d" yadp.flag ":=
dp.real scalar blow.const
: get.3.pnts
  swt.t [ 2 n.power 1 - **  3 -                          ]  -5  n>s "   "
     "cat
  swt.t [ 2 n.power 1 - **  2 -                          ]  -5  n>s "   "  11
     "cat
  "cat
  swt.t [ 2 n.power 1 - **  1 -                          ]  -5  n>s "   "
     "cat
  "cat
  swt.t [ 2 n.power 1 - **      ]  -5  n>s "cat "   " "cat
  swt.t [ 2 n.power 1 - **  1 +                          ]  -5  n>s "cat    16
  "   "  "cat
  swt.t [ 2 n.power 1 - **  2 +                          ]  -5  n>s "cat
  "   "  "cat
  swt.t [ 2 n.power 1 - **  3 +                          ]  -5  n>s "cat
\ swt.t [ 2 n.power 1 - **  2 n.power jwp.level - ** - ]  -5  n>s "   "  21
   "cat
\ swt.t [ 2 n.power 1 - **      ]  -5  n>s "cat "   " "cat
\ swt.t [ 2 n.power 1 - **  2 n.power jwp.level - ** + ]  -5  n>s "cat
  normal.coords 0.5 0.8 .025 i.cou * - position centered.label
     world.coords
;
: yadp                                                                       26
  yadp.flag   " d"  "=
  \ if  ydp   get.3.pnts
  if  ydp   get.3.pnts  file.ext make.abc
  else
      yap   get.3.pnts  file.ext make.abc                                    31
  then
;
4 string i.ele.ori.str
4 string jwp.ori.str
: app.ramp.col.blow                                                          36
  wlet tmp.s.u ":=
  tmp.s.u "upper "drop
  \ ---------------------------------------- ■
  \ \ $$[(8,512) BO31D-<POL2,Ori12r,XPt248,XPw3>]
  \ ---------------------------------------- ■                             41
  " $$[("  file.no 0 n>s "cat " ," "cat
  123.ary.n []size swap drop 0 n>s "cat
  " ) " "cat
  tmp.s.u  "cat
  \   " -p" "cat                                                           46
  \   wp.flag  0 n>s "cat
```



```
  \   " L" "cat jwp.level 0 n>s "cat
  " -" "cat " <" "cat
  jwp.ori.str "cat
  " ,Ori" "cat                                                           51
  i.ele.ori.str "cat
  " r" "cat
  " ,XPt" "cat
  i.ele  0 n>s "cat
  " ,XPw" "cat                                                           56
  n.power jwp.level -     0 n>s "cat
  \ ---------------------------------------- ■
  " >]" "cat
  123.ary.s "[ 1 ] ":=
  \                                                                      61
  123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n
  \
  to.123
  file.no 1 + file.no := \ post inc of column
;                                                                        66
: blow
  wlet tmp.s.u ":=
  tmp.s.u "upper "drop
  1 file.no :=
  sc                                                                     71
  " Make the BASIS curve first -- Lee" s.type   \  my.pause
  cr ." Wlet:"  wlet get.str  wlet ":=
  lee

  tmp.s.u " -P" "cat  wp.flag  0 n>s "cat    " L" "cat                   76
  jwp.level 0 n>s "cat     123.ary.s "[ 1 ] ":=
  \ ---------------------------------------- ■
  " P" wp.flag  0 n>s "cat
  " L" "cat jwp.level 0 n>s "cat
  jwp.ori.str ":=                                                        81
  \ ---------------------------------------- ■
  wp.flag 1 =
  if
    swp.t becomes> 123.ary.n
  else                                                                   86
    swt.t becomes> 123.ary.n
  then
  to.123
  file.ext make.abc
  i.ele  0 n>s   \ For Rotated                                           91
  \ ---------------------------------------- ■
  "dup i.ele.ori.str ":=
  \ ---------------------------------------- ■

  wp.flag  \ for recovery                                                96

  wp.flag 1 =
  if
    swp.t  becomes> swt.t
  then                                                                   101
  0    wp.flag :=
```

```
  2  0 fix.format
  wlet  3 1  "sub   tmp.s ":=
  tmp.s          " 2"   "=
  tmp.s          " 3"   "=  or                                          106
    if
                    4   \ 16phi + 16psi
    else
     tmp.s         " 4"   "=
     tmp.s         " 5"   "=  or                                        111
     tmp.s         " 6"   "=  or
     tmp.s         " 7"   "=  or
     tmp.s         " 8"   "=  or
     if
                     5   \ 32phi + 32psi                                116
     else
                     6   \ 64phi + 64psi
     then
    then
                                                                        121
\ ------
drop  6
\ ------
       jwp.level  :=
    1  n.blow     :=                                                   126
    6  n.blow     :=

    \  \\ " h"  phi.or.psi  ":=
    " s"  phi.or.psi  ":=
    \ cr ." pHi(H) or pSi(S):"  phi.or.psi  get.str  phi.or.psi  ":=   131
    cr ." pSi(s) only:"  phi.or.psi  get.str  phi.or.psi  ":=
    cr ." Default JWP Level(" wlet s.type ." ):( >4)"
         jwp.level   get.val   jwp.level  :=
    cr ." Number of Blow-Up:"            n.blow     get.val   n.blow
         :=
        " Blow Factor 2^"  S.TYPE  n.power jwp.level -   n.blow *       136
          n.type
    cr ." Blow-up Center (WB--"
    1  0 fix.format
    jwp.level  9 >=
    if                          4
    else                                                                141
      jwp.level  6 >=
      if                        3
      else
        jwp.level  3 >=
        if                      2                                       146
        else                    1
        then
      then
    then
    dup  num.dig :=    0  fix.format                                    151
    2 jwp.level 1 + ** n.type ." --WP):"
    3 0 fix.format
    \ i.ele
    2 n.power 1 - **  get.val i.ele :=    1 0 fix.format
```



```
    \ cr ." Clear (1) or Overlap:"     i.lin      get.val   i.lin     := 156
      0.    b :=
      swt.t sub[ i.ele 2 jwp.level 1 - **  1  -  - , 2 jwp.level ** ]
      b   sub[ 1 , 2 jwp.level ** ] :=
      \ ---> Always is now the "smooth information" for both psi and phi
                                                                        161
\ swt.t
\ n.wt1 2 /  i.ele -  rotate
\ 5 yap

  wlet 1 2 "sub " on"  "=                                               166
  if
    2 sqrt  n.power jwp.level - **
  else
  \   1.D
    2 sqrt  n.power jwp.level - **                                      171
  then
  blow.const  :=
  gd hp

  swt.t                                                                 176
  i.ele  n.wt1 2 /  -   neg rotate
  dup
  " r"
  "cat  \ from the first i.ele
  \ ---------------------------------------- ■                          181
  0  i.cou :=
  i.cou 0 n>s  " -" "cat  i.ele 0 n>s  "cat
  "  (" "cat
  "swap "cat " )" "cat
  " Seq. " "swap "cat \ \ added                                         186
  \ ---------------------------------------- ■
  123.ary.s "[ 1 ] ":=
  becomes> 123.ary.n  to.123
  5 yap
  file.ext make.abc                                                     191

\ swt.t [ i.ele 1 - ]  -5  n>s  "   " "cat
\ swt.t [ i.ele     ]  -5  n>s  "cat "   " "cat
\ swt.t [ i.ele 1 + ]  -5  n>s  "cat
  swt.t [ i.ele             3 -                       ]  -5  n>s "   "  196
     "cat
  swt.t [ i.ele             2 -                       ]  -5  n>s "   "
     "cat
  "cat
  swt.t [ i.ele             1 -                       ]  -5  n>s "   "
     "cat
  "cat
  swt.t [ i.ele                 ]  -5  n>s "cat "   " "cat               201
  swt.t [ i.ele             1 +                       ]  -5  n>s "cat
  "   "  "cat
  swt.t [ i.ele             2 +                       ]  -5  n>s "cat
  "   "  "cat
  swt.t [ i.ele             3 +                       ]  -5  n>s "cat    206
  "dup
```

```
\ normal.coords   0.5  0.8      position  centered.label  world.coords
  normal.coords   0.5  0.8 .025 + position  centered.label  world.coords
  \ \\ " h"  phi.or.psi  ":=
  " s"  phi.or.psi  ":=                                                  211
  1  i.cou :=
  b inverse.wt  drop
  swt.t  blow.const *  becomes> swt.t
  swt.t
  i.cou 0 n>s  " -" "cat  i.ele 0 n>s  "cat                              216
  " Seq. " "swap "cat

  123.ary.s "[ 1 ]  ":=
  swt.t  becomes> 123.ary.n  to.123
  get.p.pnts   sub[ 1 , p.pnts ]   1  yadp  lab.spe                      221
  normal.coords   0.5  0.8      position  centered.label  world.coords
  get.3.pnts
\  file.ext  make.abc

  n.blow 1 >                                                             226
  if
    begin
      i.cou  1 +  i.cou :=
      0  b :=
      swt.t sub[ 2 n.power 1 - **                                        231
                 2 jwp.level 1 - **  1  -  - , 2 jwp.level ** ]
      b   sub[ 1 , 2 jwp.level ** ] :=
      b  inverse.wt  drop
      swt.t  blow.const *  becomes> swt.t
      swt.t                                                              236
      \ ---------------------------------------- ■
      i.cou 0 n>s  " -" "cat i.ele 0 n>s "cat
      " Seq. " "swap "cat
      123.ary.s "[ 1 ]  ":=
      swt.t  becomes> 123.ary.n  to.123                                  241
      get.p.pnts  sub[ 1 , p.pnts ]   i.cou  yadp   \ ydp
      i.cou  n.blow =
    until
  then
  \ ---------------------------------------- ■                          246
  app.ramp.col.blow
  \ ---------------------------------------- ■
  normal.coords 0.5 0.8 .025 i.cou 1 + * - position
  " BLOW-UP AT POINT "  i.ele  0 n>s "cat  "  centered at point " "cat
  2 n.power 1 - **  0 n>s "cat                                           251
  centered.label world.coords
  normal.coords 0.5 0.8 .025 i.cou 2 + * - position
  " EACH BLOW-UP SCALE : 2 ** "   n.power jwp.level -     0 n>s "cat
  centered.label
  normal.coords 0.5 0.8 .025 i.cou 3 + * - position                      256
  " Wavelet: "  wlet "cat
  centered.label
  1. 1. position
  world.coords
  file.ext  make.abc                                                     261
  10 5 fix.format
```



```
  wp.flag :=  \ recover
;
```

LLet-Coe.asy

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```
: LLet-Coe.asy ; \ %----- Asyst Prog                                        1
\  Discrete Wavelet Transform
\  1.   define  PWTset
\  2.   define  PWT
\  3.   run     DWT ( <- pwt <- pwtset ) by giving n.dau.c
\ ------------------------------------------------------------------       6
nd
\ : iand  \ [ n1 , n2  --  n3 ]
\   #>mask   #>mask   and    mask>#
\ ;
                                                                           11
integer scalar n.dau.c
        scalar ncmax
        scalar alg.flag
        scalar isign
        \ scalar n.wt1 \ moved into Lee-Word.asy                           16
        scalar sp.o
        scalar a.size
        scalar b.size
        scalar c.size
        scalar p.size                                                      21
        scalar q.size
5       string wlet
\ n.fft.pts          n.wt1 :=
  50           ncmax      :=
  4            sp.o       :=                                             26
\ real  dim[  ncmax     ]  array cc
dp.real  dim[  ncmax     ]  array cc
         dim[  ncmax     ]  array cr.nr
         dim[  2         ]  array dc1
         dim[  4         ]  array dc2                                      31
         dim[  6         ]  array dc3
         dim[  8         ]  array dc4
         dim[  10        ]  array dc5
         dim[  12        ]  array dc6
         dim[  14        ]  array dc7                                      36
         dim[  16        ]  array dc8
         dim[  18        ]  array dc9
         dim[  20        ]  array dc10
         dim[  8         ]  array dc4las
         dim[  10        ]  array dc5las                                   41
         dim[  12        ]  array dc6las
         dim[  14        ]  array dc7las
         dim[  16        ]  array dc8las
         dim[  18        ]  array dc9las
         dim[  20        ]  array dc10las                                  46
dc4las  @[ 1 ]  enter[
     -.107148901418D , -.041910965125D , 0.703739068656D ,
     1.136658243408D , 0.421234534204D , -.140317624179D ,
     -.017824701442D , 0.045570345896D
     ]  drop                                                               51
dc5las  @[ 1 ]  enter[
```



```
     0.038654795955D , 0.041746864422D , -.055344186117D ,
     0.281990696854D , 1.023052966894D , 0.896581648380D ,
     0.023478923136D , -.247951362613D , -.029842499869D ,
     0.027632152958D                                                       56
     ]  drop
dc6las  @[ 1 ]  enter[
     0.021784700327D , 0.004936612372D , -.166863215412D ,
     -.068323121587D , 0.694457972958D , 1.113892783926D ,
     0.477904371333D , -.102724969862D , -.029783751299D ,                 61
     0.063250562660D , 0.002499922093D , -.011031867509D
     ]  drop
dc7las  @[ 1 ]  enter[
     0.003792658534D , -.001481225915D , -.017870431651D ,
     0.043155452582D , 0.096014767936D , -.070078291222D ,                 66
     0.024665659489D , 0.758162601964D , 1.085782709814D ,
     0.408183939725D , -.198056706807D , -.152463871896D ,
     0.005671342686D , 0.014521394762D
     ]  drop
dc8las  @[ 1 ]  enter[                                                     71
     0.002672793393D , -.000428394300D , -.021145686528D ,
     0.005386388754D , 0.069490465911D , -.038493521263D ,
     -.073462508761D , 0.515398670374D , 1.099106630537D ,
     0.680745347190D , -.086653615406D , -.202648655286D ,
     0.010758611751D , 0.044823623042D , -.000766690896D ,                 76
     -.004783458512D
     ]  drop
dc9las  @[ 1 ]  enter[
     0.001512487309D , -.000669141509D , -.014515578553D ,
     0.012528896242D , 0.087791251554D , -.025786445930D ,                 81
     -.270893783503D , 0.049882830959D , 0.873048407349D ,
     1.015259790832D , 0.337658923602D , -.077172161097D ,
     0.000825140929D , 0.042744433602D , -.016303351226D ,
     -.018769396836D , 0.000876502539D , 0.001981193736D
     ]  drop                                                               86
dc10las @[ 1 ]  enter[
     0.001089170447D , 0.000135245020D , -.012220642630D ,
     -.002072363923D , 0.064950924579D , 0.016418869426D ,
     -.225558972234D , -.100240215031D , 0.667071338154D ,
     1.088251530500D , 0.542813011213D , -.050256540092D ,                 91
     -.045240772218D , 0.070703567550D , 0.008152816799D ,
     -.028786231926D , -.001137535314D , 0.006495728375D ,
     0.000080661204D , -.000649589896D
     ]  drop
dc1  @[ 1 ]  enter[                                                        96
     1.D  2.D sqrt / , 1.D  2.D sqrt /          ]  drop
dc2  @[ 1 ]  enter[
     0.4829629131445341D ,  0.8365163037378079D ,
     0.2241438680420134D , -0.1294095225512604D ]  drop
dc3  @[ 1 ]  enter[                                                       101
     0.3326705529500826D ,  0.8068915093110925D ,
     0.4598775021184915D , -0.1350110200102545D ,
    -0.0854412738820266D ,  0.0352262918857095D ] drop
     \ ALREADY IN DOUBLE PRECISION REAL
     \ But with calculation error                                         106
\    1.  1. 10. sqrt * + 1.  5. 2. 10. sqrt * + sqrt * + 16. 2. sqrt * /
```

```
    ,
\    5.  1. 10. sqrt * + 3.  5. 2. 10. sqrt * + sqrt * + 16. 2. sqrt * /
    ,
\    10. 2. 10. sqrt * - 2.  5. 2. 10. sqrt * + sqrt * + 16. 2. sqrt * /
    ,
\    10. 2. 10. sqrt * - 2.  5. 2. 10. sqrt * + sqrt * - 16. 2. sqrt * /
    ,
\    5.  1. 10. sqrt * + 3.  5. 2. 10. sqrt * + sqrt * - 16. 2. sqrt * /
    ,
\    1.  1. 10. sqrt * + 1.  5. 2. 10. sqrt * + sqrt * - 16. 2. sqrt * /
    ] drop
dc4  @[ 1 ]  enter[
     0.2303778133088964D , 0.7148465705529154D , 0.63088076793985870 ,
     -.0279837694168599D , -.1870348117190931D , 0.0308413818355607D ,
     0.0328830116668852D , -.0105974017850690D                          116
     ] drop
dc5  @[ 1 ]  enter[
     0.16010239797419290 , 0.6038292697971895D , 0.7243085284377726D ,
     0.13842814590132030 , -.2422948870663823D , -.0322448695846381D ,
     0.07757149384004590 , -.0062414902127983D , -.0125807519990820D ,  121
     0.00333572528547380
     ] drop
dc6  @[ 1 ]  enter[
     0.1115407433500 ,  0.4946238903980 ,  0.7511339080210 ,
     0.3152503517090 , -0.2262646939650 , -0.1297668675670 ,            126
     0.0975016055870 ,  0.0275228655300 , -0.0315820393180 ,
     0.0005538422010 ,  0.0047772575110 , -0.0010773010850 ]  drop
dc7  @[ 1 ]  enter[
     0.07785205408500370 , 0.3965393194818912D , 0.7291320908461957D ,
     0.46978228740518890 , -.1439060039285212D , -.2240361849938412D ,  131
     0.07130921926682720 , 0.0806126091510774D , -.0380299369350104D ,
     -.0165745416306655D , 0.0125509985560986D , 0.0004295779729214D ,
     -.0018016407040473D , 0.0003537137999745D
     ] drop
dc8  @[ 1 ]  enter[                                                     136
     0.0544158422431072D , 0.3128715909143166D , 0.6756307362973195D ,
     0.5853546836542159D , -.0158291052563823D , -.2840155429615824D ,
     0.0004724845739124D , 0.1287474266204893D , -.0173693010018090D ,
     -.0440882539307971D , 0.0139810279174001D , 0.0087460940474065D ,
     -.0048703529934520D , -.0003917403733770D , 0.0006754494064506D ,  141
     -.0001174767841284D
     ] drop
dc9  @[ 1 ]  enter[
     0.0380779473638778D , 0.2438346746125858D , 0.6048231236900955D ,
     0.6572880780512736D , 0.1331973858249883D , -.2932737832791663D ,  146
     -.0968407832229492D , 0.1485407493381256D , 0.0307258147933385D ,
     -.0676328290613279D , 0.0002509471148340D , 0.0223616621236798D ,
     -.0047232047577518D , -.0042815036824635D , 0.0018476468830563D ,
     0.0002303857635232D , -.0002519631889427D , 0.0000393473203163D
     ] drop                                                             151
dc10 @[ 1 ]  enter[
     0.0266700579010 ,  0.1881768000780 ,  0.5272011889320 ,
     0.6884590394540 ,  0.2811723436610 , -0.2498464243270 ,
    -0.1959462743770 ,  0.1273693403360 ,  0.0930573646040 ,
    -0.0713941471660 , -0.0294575368220 ,  0.0332126740590 ,            156
```



```
     0.0036065535670 , -0.0107331754830 ,  0.0013953517470 ,
     0.0019924052950 , -0.0006858566950 , -0.0001164668550 ,
     0.0000935886700 , -0.0000132642030 ]  drop
token  tmp.t  exp.mem> tmp.t
token  csa    exp.mem> csa                                               161
token  csb    exp.mem> csb
token  csp    exp.mem> csp
token  csq    exp.mem> csq
integer scalar sp.order
: make.csabpq.1                                                         166
   tmp.t  dup  sub[ 1 , tmp.v.i ]  rev[ 1 ]  swap catenate  becomes> csp
  2              dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.5D , 0.5D
   ] drop                                                               171
   tmp.t   becomes> csa
\   csa  becomes> csb
\   csp  becomes> csq
;
: bo11                                                                  176
  2  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.5D , 0.5D
   ] drop                                                               181
   tmp.t                                                  becomes>
      csp
   csp                                                    becomes>
      csa
;
: bo13
  3  tmp.v.i :=                                                         186
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.5D ,   1.D 16.D / ,  -1.D 16.D /
   ]  drop
  make.csabpq.1                                                         191
;
: bo15
  5  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[                                                196
   0.5D , 11.D 128.D / , -11.D 128.D / ,
   -3.D 256.D / , 3.D 256.D /
   ]  drop
  make.csabpq.1
;                                                                       201
: make.csabpq.2
   tmp.t  dup  sub[ 2 , tmp.v.i 1 - ]  rev[ 1 ]  swap catenate becomes>
      csp
  3              dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.25D ,  0.50D ,  0.25D                                              206
   ] drop
   tmp.t                                              becomes> csa
```

```
   csa  becomes> csb
   csp  becomes> csq
;                                                                    211
: bo22
  3  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.75D , 0.25D , -0.125D                                           216
   ]  drop
  make.csabpq.2
;
: bo24
  5  tmp.v.i :=                                                     221
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   45.D 64.D / , 19.D 64.D / ,  -1.D 8.D / ,  -3.D 64.D / , 3.D 128.D /
   ]  drop
  make.csabpq.2                                                      226
;
: bo26
  7  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[                                             231
   175.D 256.D / , 81.D 256.D / , -123.D 1024.D / , -39.D 512.D / ,
   17.D 512.D / , 5.D 512.D / , -5.D 1024.D /
   ]  drop
   make.csabpq.2
;                                                                    236
: bo28
  9  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   22050.D , 10718.D , -3796.D , -3126.D ,                           241
   1228.D  ,  670.D  ,  -300.D ,   -70.D ,  35.D
   ]  drop
   make.csabpq.2
   csp  2.D -15.D ** *   becomes> csp
;                                                                    246
: make.csabpq.3
   tmp.t  dup  sub[ 1 , tmp.v.i ]  rev[ 1 ]  swap catenate becomes> csp
  4              dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.125D , 0.375D ,  0.375D , 0.125D                                251
   ] drop
   tmp.t   becomes> csa
;
: bo31
  2  tmp.v.i :=                                                     256
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   .75D , -.25D
   ]  drop
   make.csabpq.3                                                     261
;
: bo33
```



```
  4  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[                                             266
   45.D 64.D / , -7.D 64.D / , -9.D 64.D / , 3.D 64.D /
   ]  drop
   make.csabpq.3
;
: bo35                                                               271
  6  tmp.v.i :=
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   175.D 256.D / , -13.D 256.D / , -97.D 512.D / , 19.D 512.D / ,
   15.D 512.D / , -5.D 512.D /                                       276
   ]  drop
   make.csabpq.3
;
: bo37
  8  tmp.v.i :=                                                     281
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   11025.D , -307.D  , -3489.D ,   336.D ,
   865.D   , -195.D  ,  -105.D ,    35.D
   ]  drop                                                           286
   make.csabpq.3
   csp  2.D -14.D ** *   becomes> csp
;
: bo39
  10  tmp.v.i :=                                                    291
  tmp.v.i        dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   87318.D , 190.D , -29676.D , 1140.D , 9188.D , -1308.D ,
   -1911.D , 469.D , 189.D , -63.D
   ]  drop                                                           296
   make.csabpq.3
   csp  2.D -17.D ** *   becomes> csp
;
: so3 \ use odd number of coeff.
  4  sp.order :=                                                    301
  \ csa []size   2 /  tmp.v.i :=  drop
  20  tmp.v.i :=
   tmp.v.i  1 +  dp.real ramp   becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   0.6315615124035756 ,                                              306
   0.2833241287791393 ,
  -0.1995539275818 ,
  -0.1647025826446927 ,
   0.0912758685480245 ,
   0.0894189178498617 ,                                              311
  -0.04696662484663471 ,
  -0.04801510203667939 ,
   0.02493689963969966 ,
   0.02572001001600068 ,
  -0.01330469960239009 ,                                             316
  -0.0137696808134998 ,
   0.007118265435884861 ,
```

```
 0.007370917988870163 ,
-0.003809841711572108 ,
-0.003945542141907374 ,                                          321
 0.002039281445696639 ,
 0.002111975662281219 ,
-0.001091581045517322 ,
-0.001130499753033917 ,
 0.0005843011868825511 ,                                         326
 ]  drop
tmp.t  dup  sub[ 2 , tmp.v.i ]  rev[ 1 ]  swap catenate becomes> csa

20  tmp.v.i :=
 tmp.v.i  1 +  dp.real ramp   becomes> tmp.t                     331
 tmp.t  @[ 1 ]  enter[
-1.043261469941104 ,
 0.3312247945402051 ,
 0.5247423148960167 ,
-0.2444969416039156 ,                                            336
-0.2755917431211694 ,
 0.1391545679803643 ,
 0.1468596002088173 ,
-0.07550189463168975 ,
-0.07853017653475226 ,                                           341
 0.04053910511068559 ,
 0.04202575195946283 ,
-0.02171503773409453 ,
-0.02249434750478476 ,
 0.01162550347729064 ,                                           346
 0.01204063510565295 ,
-0.006223133530293623 ,
-0.006445098095866915 ,
 0.003331149664619865 ,
 0.003449932648653844 ,                                          351
-0.001783102667159073 ,
-0.001846681160105444
]  drop
tmp.t  dup  sub[ 2 , tmp.v.i ]  rev[ 1 ]  swap  catenate becomes> csb
                                                                 356
2  tmp.v.i :=
 tmp.v.i  1 +  dp.real ramp   becomes> tmp.t
 tmp.t  @[ 1 ]  enter[
 0.53033008588991064 ,
 0.353553390593273762 ,                                          361
 0.088838347648318441
]  drop
tmp.t  dup  sub[ 2 , tmp.v.i ]  rev[ 1 ]  swap  catenate becomes> csp

5   tmp.v.i :=                                                   366
 tmp.v.i  1 +  dp.real ramp   becomes> tmp.t
 tmp.t  @[ 1 ]  enter[
-0.42552675939261878 ,
 0.32412568278496457 ,
-0.138615376946886697 ,                                          371
 0.029410170437744053 ,
-0.0021746339500776759 ,
```



```
  0.000017537370565142548
 ]  drop
 tmp.t  dup  sub[ 2 , tmp.v.i ]  rev[ 1 ]  swap  catenate becomes> csq  376
;
: cc1
 6  tmp.v.i :=
 tmp.v.i        dp.real ramp   becomes> tmp.t
  tmp.t  @[ 1 ]  enter[                                                381
  -.051429728471D ,  .238929728471D ,  .602859456942D ,  .272140543058D
      ,
  -.051429972847D , -.011070271529D
  ] drop
  tmp.t    becomes> csp
;                                                                      386
: cc2
 12 tmp.v.i :=
 tmp.v.i        dp.real ramp   becomes> tmp.t
  tmp.t  @[ 1 ]  enter[
   .011587596739D , -.029320137980D , -.047639590310D ,  .273021046535D  391
      ,
   .5746823938 57D ,  .294867193696D , -.054085607092D , -.042026480461D
      ,
   .016744410163D ,  .003967883613D , -.001289203356D , -.000509505399D
  ] drop
  tmp.t    becomes> csp
;                                                                      396
: cc3
 18 tmp.v.i :=
 tmp.v.i        dp.real ramp   becomes> tmp.t
  tmp.t  @[ 1 ]  enter[
  -.002682418671D ,  .005503126709D ,  .016583560479D , -.046507764479D  401
      ,
  -.043220763560D ,  .286503335274D ,  .561285256870D ,  .302983571773D
      ,
  -.050770140755D , -.058196250762D ,  .024434094321D ,  .011229240962D
      ,
  -.006369601011D , -.001820458916D ,  .000790205101D ,  .000329665174D
      ,
  -.000050192775D , -.000024465734D
  ] drop                                                               406
  tmp.t    becomes> csp
;
: cc4
 24 tmp.v.i :=
 tmp.v.i        dp.real ramp   becomes> tmp.t                         411
  tmp.t  @[ 1 ]  enter[
   .000630961046D , -.001152224852D , -.005194524026D ,  .011362459244D
      ,
   .018867235378D , -.057464234429D , -.039652648517D ,  .293667390895D
      ,
   .553126452562D ,  .307157326198D , -.047112738865D , -.068038127051D
      ,
   .027813640153D ,  .017735837438D , -.010756318517D , -.004001012886D  416
      ,
   .002652665946D ,  .000895594529D , -.000416500571D , -.000183829769D
```

```
        ,
     .000044080354D ,  .000022082857D , -.000002304942D , -.000001262175D
    ] drop
    tmp.t     becomes> csp
;                                                                          421
: cc5
  30 tmp.v.i :=
  tmp.v.i          dp.real ramp    becomes> tmp.t
   tmp.t  @[ 1 ]  enter[
   -.0001499638D ,     .0002535612D ,     .0015402457D ,    -.0029411108D ,  426
   -.0071637819D ,     .0165520664D ,     .0199178043D ,    -.0649972628D ,
   -.0368000736D ,     .2980923235D ,     .5475054294D ,     .3097068490D ,
   -.0438660508D ,    -.0746522389D ,     .0291958795D ,     .0231107770D ,
   -.0139736879D ,    -.0064800900D ,     .0047830014D ,     .0017206547D ,
   -.0011758222D ,    -.0004512270D ,     .0002137298D ,     .0000993776D ,  431
   -.0000292321D ,    -.0000150720D ,     .0000026408D ,     .0000014593D ,
   -.0000001184D ,    -.0000000673D
   ] drop
    tmp.t     becomes> csp
;                                                                          436
```

LLet-DnR.asy

A01764-20161209-A018 ❖ December 9, 2016 ❖ [Page count: 3]

```
: LLet-DnR.asy ; \ %----- Asyst Prog

4 string PhiPsi.str
\ 0   to.stack.flag :=
\ 1   to.123.flag   :=
\ 8 string  tmp.s.u \ don't change the case of wlet -- don't use wlet
   "upper

: dec&rec
  \  512  n.wt1         :=
  \  2    jwp.level     :=
  \  8    i.ele         :=
  \  382  i.ele         :=       \ bo:  2^jwp.level --> 1 ,  i --> i+1 for
     B.O

  i.ele  2  jwp.level **  <=
  wlet tmp.s.u ":=
  tmp.s.u "upper "drop
  if
     tmp.s.u " -Phi"  "cat  123.ary.s  "[ 1 ] ":=
     " Phi-"  PhiPsi.str ":=
  else
     tmp.s.u " -Psi"  "cat  123.ary.s  "[ 1 ] ":=
     " Psi-"  PhiPsi.str ":=
  then
\   if
\      wlet " -Phi"  "cat  123.ary.s  "[ 1 ] ":=
\      " Phi-"  PhiPsi.str ":=
\   else
\      wlet " -Psi"  "cat  123.ary.s  "[ 1 ] ":=
\      " Psi-"  PhiPsi.str ":=
\   then
  \ ---------------------------------------- ■
  " Element: "  i.ele 0 n>s "cat
  \
  " , JWP level: "  jwp.level 0 n>s "cat
  "  (pt"  "cat 2 jwp.level ** 0 n>s  "cat " )"  "cat
  "cat
  " , Scale "  jwp.level 0 n>s "cat  " ->" "cat
  n.power 0 n>s "cat \ " )" "cat
  "cat
  123.ary.s  "[ 2 ]  ":=
  \ ---------------------------------------- ■

  2  gp.flag    :=
  \ 123.ary.s  "[ 1 ]  " -Reconstructed" "cat 123.ary.s  "[ 1 ]  ":=
  123.ary.tmp  becomes> 123.ary.n
  i.ele 2 <=
  if
    123.ary.n  @[ 1 ]  enter[
      jwp.level
    , n.power
```



```
    , i.ele
    , i.ele
    , swt.t [ i.ele     ]
    , swt.t [ i.ele 1 + ]
    , swt.t [ i.ele 2 + ]
    , swt.t [ i.ele 3 + ]
    ]  drop
  else
    123.ary.n  @[ 1 ]  enter[
      jwp.level
    , n.power
    , i.ele
    , i.ele 2 -
    , swt.t [ i.ele 2 - ]
    , swt.t [ i.ele 1 - ]
    , swt.t [ i.ele     ]
    , swt.t [ i.ele 1 + ]
    , swt.t [ i.ele 2 + ]
    , swt.t [ i.ele 3 + ]
    ]  drop
  then
  to.123
  1  gp.flag    :=

  get.p.pnts
  0.  b :=
  1. b [ i.ele ] :=
  b inverse.wt  drop
  1 gp.flag :=
  \ " n" tmp.s  ":=  swt.t  to.123
  swt.t  becomes>  123.ary.n  to.123
  swt.t    sub[ 1 , p.pnts ]
  gd up
  1 yap
  normal.coords
  i.ele  2  jwp.level **  <=
  if
     " h"     phi.or.psi  ":=
     " -PHI"
  else
     " s"     phi.or.psi  ":=
     " -PSI"
  then
  "  (From scale " "cat  jwp.level 0 n>s "cat  " -->" "cat
  n.power 0 n>s "cat  " )" "cat
\   \ ---------------------------------------- ■
\   " Element: "  i.ele 0 n>s "cat
\   \
\   " , JWP level: "  jwp.level 0 n>s "cat
\   "  (pt"  "cat 2 jwp.level ** 0 n>s  "cat " )"  "cat
\   "cat
\   " , Scale "  jwp.level 0 n>s "cat  " ->" "cat
\   n.power 0 n>s "cat \ " )" "cat
\   "cat
\   123.ary.s  "[ 2 ]  ":=
```

```
\    \ ---------------------------------------- ■                          106
\    " From scale "  jwp.level 0 n>s "cat   " -->" "cat
\    n.power 0 n>s "cat \ " )" "cat
\    123.ary.s  "[ 2 ]  ":=
\    " Element: "  i.ele 0 n>s "cat
\    123.ary.s  "[ 3 ]  ":=                                                  111
\    " JWP level: "  jwp.level 0 n>s "cat
\    "  ("  "cat 2 jwp.level ** 0 n>s  "cat " )"  "cat
\    123.ary.s  "[ 4 ]  ":=
   \ ---------------------------------------- ■
\   wlet  1 4 "sub                                                           116
   wlet  1 5 "sub
   wlet  5 1 "sub    " d"  "=
   wlet  3 1 "sub    " d"  "=  or
   if    "  (Dual)"  "cat  then
   "swap  "cat                                                              121
   0.5  0.9   position  centered.label
   world.coords
   swt.t forward.wt  drop
   dp swt.t sub[ 1 , p.pnts ] 2 yap
   swt.t [ i.ele 1 - ]  -4  n>s  "   "  "cat                               126
   swt.t [ i.ele     ]  -4  n>s  "cat   "   "  "cat
   swt.t [ i.ele 1 + ]  -4  n>s  "cat
   normal.coords
   0.5  0.9   position  centered.label
   " with center at position "                                              131
   i.ele
   0 n>s  "cat "  (" "cat wlet "cat " )" "cat
   0.5  0.85  position  centered.label
   1.   1.    position  world.coords
                                                                            136
\    2  gp.flag    :=
\    123.ary.s  "[ 1 ]  " -m"  "cat   "upper 123.ary.s  "[ 1 ]  ":=
\    123.ary.tmp  becomes> 123.ary.n
\    123.ary.n  @[ 1 ]  enter[
\      jwp.level                                                             141
\    , n.power
\    , swt.t [ i.ele 1 - ]
\    , swt.t [ i.ele     ]
\    , swt.t [ i.ele 1 + ]
\    , i.ele                                                                 146
\    ]  drop
\    to.123

   {hp.wnd} sc
   hp  file.ext  make.abc                                                   151
   \   8 5 fix.format swt.t sub[ 11 , 3 ] . wlet s.type
   \   my.pause
;
```

LLet-Ent.asy


```
: LLet-Ent.asy ; \ %----- Asyst Prog

\  Entropy of Distribution
\  e.g.   array abs 300 entropy  \ L**1
\         array     300 entropy  \ relative value
\         array    -300 entropy  \ L**2
\
\

dp.real  scalar t1.max  scalar t1.min  scalar t1.div
integer scalar vi1  scalar vi2  scalar vi3 scalar ic
        scalar #.div.p   scalar #.ele   scalar #.div  scalar abs.flag

: entropy.prob \ [ array  -- entropy ]
  abs.flag 1 =
  if
    abs
  then
  becomes> t1
  #.div.p 0 <
  if
    #.div.p abs #.div.p :=
    t1 abs
    dup *
    becomes> t1
  then
  t1  []size     #.ele :=
      sort
  becomes> t1
  t1 [ #.ele ]  t1.max :=
  t1 [ 1     ]  t1.min :=
  t1.min 0.  >=
  if
    0.          t1.min :=  \ forced for absolute magnitude
  then

  real #.div.p ramp
  becomes> t2
  0.00000000001D  t2  :=   \ make it tiny for 0 provbability

  0   vi1 :=
  0   vi2 :=
  Begin
    vi2 1 +  vi2 :=
    t1.min   t1.max t1.min - #.div.p float / vi2 *  +     t1.div :=
    0  ic :=
    begin
      vi1 1 +  vi1 :=
      ic  1 +  ic  :=

      t1  [ vi1 ]  t1.div  >=
      vi1  #.ele =  or
```



```
      ?dup
      if
        vi2  #.div.p <
        t1  [ vi1 ]  t1.max  =  and
        if
          #.div.p  vi2 :=
          1  ic :=
        then
        vi2  #.div.p =
        t1  [ vi1 ]  t1.max  =  or
        if
          begin
            vi1  #.ele  <
            if
              vi1 1 +  vi1 :=
              ic  1 +  ic  :=
            then
            vi1  #.ele  =
          until
          ic 1 +  ic :=
        then
        vi2 1 =
        if
          ic 1 -  t2  [ vi2 ]  :=
        else
          ic      t2  [ vi2 ]  :=
        then
      then
    until
    \ \ \ cr  vi2 n.type   ic .   vi1 .
    vi1  #.ele =
    vi1  #.ele float  #.div.p float /  vi2 float *  >=  or
    vi2  #.div.p = and
  Until

  t2 float  #.ele float /  becomes> t2  \ pdf
  t2 LN t2 * neg
  []sum
;

: entropy.coef \ [ array --- entropy ]
  abs.flag 1 =
  if
    abs
  then
  becomes> t1
  t1 []size #.ele := drop
  0  vi1  :=
  begin
    vi1 1 +  vi1 :=
    t1 [  vi1 ]  abs  0.  =
    if
      0.000000000001D  t1 [ vi1 ] :=
    then
    vi1 #.ele  =
```

```
  until
  t1 dup *  dup LN  *   neg  []sum
  t1 dup *  []sum      /
  t1 dup *  []sum  LN  +                                          111
  \  becomes> t3
;
: entropy \ [ array , #.div.p  -- ]
  #.div.p :=
  #.div.p  0  =                                                   116
  if
    entropy.coef
  else
    entropy.prob
  then                                                            121
;
: awp.t.ent
  #.div  :=
  jwp.level 0 =
  if                                                              126
    \ awp.t xsect[ n.power 1 + , ! ] abs dup *    #.div.p  entropy
    awp.t xsect[ n.power 1 + , ! ]                #.div entropy
    0  tmp.v.i :=
    1  tmp.v.i.2 :=
  else                                                            131
    jwp.level  1 - tmp.v.i :=
    0  tmp.v.i.2 :=
  then

  begin                                                           136
    tmp.v.i 1 +  tmp.v.i :=
    \ awp.t xsect[ tmp.v.i , ! ] abs dup *    #.div.p  entropy
    awp.t xsect[ tmp.v.i , ! ]                #.div  entropy
    tmp.v.i.2 1 =
    if                                                            141
      catenate
    then
    1 tmp.v.i.2 :=
    tmp.v.i  n.power =
  until                                                           146
  norm.v                                    #.div  entropy
  catenate
  norm.v.s                                  #.div  entropy
  catenate
  \ dup exp  \ theoretical dimension                              151
;
: ent.bat
  dir.lee.asc  now.file "cat  ftoa.bat
  get.sub.a
  forward.wt                                                      156
  dup  1 yap
  #.div        entropy
  becomes>   123.ary.n
  wlet  " -" "cat   #.div.p 0 n>s  "cat  123.ary.s  "[ 1 ]  ":=
  123.ary.s  "[ 1 ]  0.5  0.05   lab.x                            161
  to.123
```



```
  hp file.ext make.abc
;
```

LLet-Lev.asy

A01766-20161209-A020 ❖ December 9, 2016 ❖ [Page count: 4]

```
: LLet-Lev.asy ; \ For showing WB and WP at various levels/points \ -*-   1
   txt:asy -*-

: lee.auto
  isign  -1  =
  if
    n.wt1  dp.real ramp  becomes> b                                        6
    1  0 fix.format
    0.  b  :=
    \ cr ." JWP Level(" wlet s.type ." ):"  jwp.level  get.val
       jwp.level :=
\ ------------------------------------------------------------------
    cr ." Element "                                                       11
    wp.flag 1 =
    if
      " (WP: located at level "  jwp.level 0 n>s "cat " )" "cat s.type.3
    else
      " (WB: min. level at "  jwp.level 0 n>s "cat " )" "cat s.type.3     16
    then
    ." (Phi<-"
    1  0 fix.format
    jwp.level  9 >=
    if                          4                                         21
    else
      jwp.level  6 >=
      if                        3
      else
        jwp.level  3 >=                                                   26
        if                      2
        else                    1
        then
      then
    then                                                                  31
    dup  num.dig :=    0  fix.format
    2 jwp.level     ** n.type ." /->Psi:[WB"
    \ ---------------------------------------- ■
    wp.flag 1 =
    if                                                                    36
      ." <-"
      1  0 fix.format
      jwp.level  9 >=
      if                          4
      else                                                                41
        jwp.level  6 >=
        if                        3
        else
          jwp.level  3 >=
          if                      2                                       46
          else                    1
          then
        then
      then
```



```
      dup  num.dig :=    0  fix.format                                    51
      2 jwp.level 1 + ** n.type ." /->WP]): "
    else
      ." ]): "
    then
\ ------------------------------------------------------------------     56
    3 0 fix.format
    \ i.ele get.val i.ele :=
    1 0 fix.format
    \ cr ." Clear (1) or Overlap:"     i.lin      get.val    i.lin     :=
    1.  b [ i.ele ] :=                                                    61
    b  inverse.wt
    wp.flag 1 =
    if
      drop  swp.t
    else                                                                  66
      drop  swt.t
    then
  else
    {hp.wnd}  " Have you set B (in --> mode)?" s.type  \ my.pause
    cr ." Choose array for Forward Transform "                            71
    " 0:default B, 1:WB.t, 2:WP.t" s.type.3
    0 get.val
    case
      1  of   swt.t  endof
      2  of   swp.t  endof                                                76
      0  of   b      endof
    endcase
    previous.window
    forward.wt     \ always d.t for WB and WP -- set Wp.flag
  then                                                                    81
  n.power  10 = if  sub[ 1 , 1000 ] then
  n.power   9 = if  sub[ 1 ,  500 ] then
  n.power   8 = if  sub[ 1 ,  250 ] then
  n.power   7 = if  sub[ 1 ,  120 ] then
  n.power   6 = if  sub[ 1 ,   70 ] then                                  86
  i.lin
  i.lin     1 =
  if  yap   lab.spe   else  ydp  then
  10 5 fix.format
;                                                                         91

dir.asy.sys       " 123io.sov" "cat       defer>  load.overlay
: set.123.auto
  {29.line}
  123.file.name                                                           96
  dir.lee.asc "len  1 +   "drop
  "dup "len "drop  dir.lee.asc "len "drop -  "sub  123.file.name.1 ":=
  dir.asy.sys       " 123io.sov" "cat       defer>  load.overlay
  dir.lee.asc
  \ cr  ." 123 file 1 name:"  " 123.wks"    get.str                     101
  cr  ." 123 file 1 name (close all wks files first!):"
  123.file.name.1
  \ \ for auto \ get.str
  "cat   123.file.name.1  ":=
```

```
  dir.lee.asc                                                                    106
  cr  ." 123 file 2 name:"  " 1234.wks"
  \ \ for auto \ get.str
  "cat   123.file.name.2  ":=
  cr  ." Group flag:"  gp.flag
  \ \ for auto \ get.val                                                         111
  gp.flag :=
  cr  ." file.no:"     file.no
  \ \ for auto \ get.val
  file.no :=
  123.file.name.1      defer>  123file.create                                    116
  123.file.name.2      defer>  123file.create
  cr  ." Initial all WKS files (Yes:999)!!:" 0
  \ \ for auto \ get.val
  999 =
  if                                                                            121
    dir.lee.asc  " le"     "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " me"     "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " so"     "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " ona"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " ons"    "cat  " .wks" "cat  defer> 123file.create            126
    dir.lee.asc  " bo1"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " bo2"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " bo3"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " 1234"   "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " 123999" "cat  " .wks" "cat  defer> 123file.create            131
  then
  123.file.name.1  123.file.name ":=
  release.overlay
;
release.overlay                                                                 136
: set.let.auto
  hp.menu.wnd \  {border}
  sc
  set.let.p1
\   2   0  goto.xy                                                              141
\       ." Wavelet (" " on22a/s, bo220/d, so0/d , le, me" s.type ." ):"
\       b.t
\       wlet
\       \ \ for auto get.str
\       wlet ":=                                                              146
\       b.t
\   60  0  goto.xy    2  0 fix.format
\       \ ." <- or -> :"          -1  get.val isign :=
\       ." <- or -> :"     isign get.val isign :=
\       1 0 fix.format                                                        151
\   2   1  goto.xy
\       ." WP(1) / WB(0):"   wp.flag 1 = if " WP(1)" else " WB(0)"  then
\       s.type   wp.flag  get.val  wp.flag :=
\   30  1  goto.xy
\       ." JWP Level:"   jwp.level  get.val  jwp.level :=                     156
\   60  1  goto.xy     4 0 fix.format
\       ." #.pnts:"          n.wt1  get.val  n.wt1 :=
\   2   2  goto.xy     2 0 fix.format
\       ." .Pcx: "                  file.ext  get.str file.ext ":=
```



```
\   30  2  goto.xy                                                             161
\       ." 123->"           wlet " .wks" "cat  get.str tmp.s  ":=
\   60  2  goto.xy
\       ." File.#:"                 file.no   get.val file.no   :=
  2   0  goto.xy
      ." Wavelet (" " on22a/s, bo220/d, so0/d , le, me" s.type ." ):"           166
      b.t
      wlet          wlet ":=
      b.t
  60  0  goto.xy     2  0 fix.format
      \ ." <- or -> :"              -1  get.val isign :=                        171
      ." <- or -> :"      isign          isign :=
      1 0 fix.format
  2   1  goto.xy
      ." WP(1) / WB(0):"   wp.flag 1 = if " WP(1)" else " WB(0)"  then
      s.type   wp.flag           wp.flag :=                                     176
  30  1  goto.xy
      ." JWP Level:"   jwp.level           jwp.level :=
  60  1  goto.xy     4 0 fix.format
      ." #.pnts:"          n.wt1           n.wt1 :=
  2   2  goto.xy     2 0 fix.format                                             181
      ." .Pcx: "                  file.ext          file.ext ":=
  30  2  goto.xy
      ." 123->"           wlet " .wks" "cat          tmp.s  ":=
  60  2  goto.xy
      ." File.#:"                 file.no           file.no   :=                186
  \ ---------------------------------------- -
  \ wlet " .wks" "cat  get.str tmp.s  ":=
  \ ---------------------------------------- -
  dir.lee.asc   tmp.s  "cat   123.file.name  ":=
  isign 1 =                                                                     191
  if
    \ n.wt1  dp.real ramp  becomes> b
    \ 0   b  :=
    cr
    " Has B been set?!"  s.type                                                 196
  then
\ 123.file.name     defer>  123file.create
\ release.overlay
\ previous.window
;                                                                             201
```

LLet-Mai.asy

A01767-20161209-A021 ❖ December 9, 2016 ❖ [Page count: 25]

```
: LLet-Mai.asy ; \ %----- Asyst Prog                                          1
\ ------------------------------------------------------------------
\  1   Wavelet transform (s.o, o.n)
\  2   Wavelet packet transform (o.n)
\  3.  Both forward and backward
\  4.  Implementing both periodic and aperiodic WT                          6
\  5.  The periodic WT is reversable, i.e., allows perfect
   reconstruction
\  6.  The aperiodic WT is optimized to reduce edge effects, its
   reconstruction
\      may show differences from original data
\  7.  keywords:  indexing,  wrapping,  domains
\  8.  The time used is much less than NR book                             11
\
\  Written : Y.R. Lee
\ ------------------------------------------------------------------

\ integer scalar n.fft.pts                                                 16
\         scalar  n.wt1
\         scalar  isign
integer scalar n.power
        scalar aper.flag
        scalar abs.flag                                                    21
        scalar icd
        scalar icu
        scalar jwp  scalar kwp  scalar mwp
        scalar jwp.level
        scalar wp.flag                                                     26
        scalar jwp_m
        scalar i.ele
        scalar a0.i scalar b0.i scalar p0.i scalar q0.i
integer scalar  in
        scalar  im                                                         31
        scalar  ik
        scalar  no2
        scalar  nn
        scalar  domain.flag
\ integer scalar  c.size                                                   36

real    scalar var.frac
real scalar norm.keep.p.best
12 string now.file
token awp.t  exp.mem> awp.t                                                41
token uwp.t  exp.mem> uwp.t
token vwp.t  exp.mem> vwp.t
token swp.t  exp.mem> swp.t
token swt.t  exp.mem> swt.t
token bwp.t  exp.mem> bwp.t \ <--> b                                       46
26 0   26 79  window {tmp.wnd}
previous.window
: my.power
  trunc
```



```
  0  n.power  :=                                                           51
  begin
    2  /
    dup
    dup  1  >=  if   n.power   1 +   n.power :=  then
    1  =                                                                   56
  until
  drop
;
token  a1.t  exp.mem>  a1.t
token  a2.t  exp.mem>  a2.t                                                61
token  a3.t  exp.mem>  a3.t
token  at.t  exp.mem>  at.t
token  rt.t  exp.mem>  rt.t
token  wt.t  exp.mem>  wt.t
token  ct.t  exp.mem>  ct.t                                                66
token  s.t   exp.mem>  s.t
token  ht.t  exp.mem>  ht.t
token  hf.t  exp.mem>  hf.t
token  gt.t  exp.mem>  gt.t
token  gf.t  exp.mem>  gf.t                                                71
token   u.t  exp.mem>  u.t
token   v.t  exp.mem>  v.t
token   d.t  exp.mem>  d.t
token  a.coef  exp.mem> a.coef
token  b.coef  exp.mem> b.coef                                             76
token  p.coef  exp.mem> p.coef
token  q.coef  exp.mem> q.coef
token p.token exp.mem> p.token    token q.token exp.mem> q.token
token a.token exp.mem> a.token    token b.token exp.mem> b.token
1  string phi.or.psi                                                       81
" s" phi.or.psi  ":=

.975 norm.keep.p.best :=

\ ================================================================        86
: get.0.i.phi.or.psi
\ i.ele  2 jwp.level ** <=
\ if
\   phi.or.psi  " h" ":=
\ else                                                                     91
\   phi.or.psi  " s" ":=
\ then
  phi.or.psi  " h"   "=
  \ i.ele  2 jwp.level ** <=
  if                                                                       96
    wlet 1 2 "sub  " on"  "=
    if
    \      p0.i 4 +   p0.i :=
    \      q0.i 4 +   q0.i :=
    \      a0.i 4 -   a0.i :=                                             101
    \      b0.i 4 -   b0.i :=

    \  p0.i 3 +   p0.i :=
    \  q0.i 3 +   q0.i :=
```

```
    \  a0.i 3 -   a0.i :=                                          106
    \  b0.i 3 -   b0.i :=
    else
    wlet 1 3 "sub  " bo3"  "=
    if
       p0.i 3 +   p0.i :=                                          111
       q0.i 3 +   q0.i :=
       a0.i 3 -   a0.i :=
       b0.i 3 -   b0.i :=
    then
    then                                                           116
  then
;
\ ------------------------------------------------------------------
: get.0.i.bo
  wlet  3 1 "sub  " 2"  "=     \ odd number of coef.               121
  if
     1  p0.i :=
     0  q0.i :=
    -1  a0.i :=
     0  b0.i :=                                                    126
  else
     \ (bo13 ---> 2 0 -1 1 )  (0 -2 1 3 ) ( 2 0 -1 3 ) (1 -1 0 2)
     2  p0.i :=
    -0  q0.i :=
    -1  a0.i :=                                                    131
     1  b0.i :=
  then
  get.0.i.phi.or.psi
;
\ ------------------------------------------------------------------136
: get.0.i.on.c \ Coiflet
   c.size 2 /   2  modulo       0 =
   c.size 2 /   2  modulo       1 = or
   if
     p.size 2  /    tmp.v.i  :=    \ For O.N.  (all equal)          141
       0           neg   tmp.v.i +    p0.i  :=
       q.size 2 -  neg   tmp.v.i +    q0.i  :=   \ q(n)=-1**n * p(-n+1)
       a.size 1 -  neg   tmp.v.i +    a0.i  :=
       1           neg   tmp.v.i +    b0.i  :=
   \  (       4 --->  2 0 -1 1)  (6 ---> 3 -1 -2 2) ........       146
   \  (  n.dau.c -->  p q  a b)
   then
   get.0.i.phi.or.psi
;
\ ------------------------------------------------------------------151
: get.0.i.on
   c.size 2 /   2  modulo       0 =
   c.size 2 /   2  modulo       1 = or
   if
     p.size 2  /    tmp.v.i  :=    \ For O.N.  (all equal)          156
       0           neg   tmp.v.i +    p0.i  :=
       q.size 2 -  neg   tmp.v.i +    q0.i  :=   \ q(n)=-1**n * p(-n+1)
       a.size 1 -  neg   tmp.v.i +    a0.i  :=
       1           neg   tmp.v.i +    b0.i  :=
```



```
   \  (       4 --->  2 0 -1 1)  (6 ---> 3 -1 -2 2) ........       161
   \  (  n.dau.c -->  p q  a b)
   then
   get.0.i.phi.or.psi

;                                                                  166
\ ------------------------------------------------------------------
: get.0.i.so \ so3
     0  p0.i :=
     3  q0.i :=
     0  a0.i :=                                                    171
    -3  b0.i :=
  get.0.i.phi.or.psi
;
\ ------------------------------------------------------------------
: get.0.i.le&me                                                    176
  get.0.i.on
;
\ ==================================================================
dp.real scalar abpq.con
real                                                               181
: get.abpq.size
  csp  []size   p.size :=  drop
  csq  []size   q.size :=  drop
  csa  []size   a.size :=  drop
  csb  []size   b.size :=  drop                                    186
;
\ ------------------------------------------------------------------
: get.abpq
  wlet  1 2 "sub  " on"  "=
  wlet  1 2 "sub  " le"  "=  or                                    191
  wlet  1 2 "sub  " me"  "=  or
  if
    wlet  1 2 "sub  " le"  "=
    wlet  1 2 "sub  " me"  "=  or
    wlet  5 1 "sub  " a"   "=  or   \ asymmetric  (on22--00a)      196
    if
      1.D             abpq.con  :=
    else
      2.D  sqrt  inv  abpq.con  :=  \ lease asymmetric (on44--00s)
    then                                                           201
    wlet  5 1 "sub  " c"   "=       \ Coiflet     (on11--55c)
    if
      2.D  sqrt       abpq.con  :=
    then
  else                                                             206
     2.D  sqrt       abpq.con  :=
  then

  csp  abpq.con  *  \ reconstrution
    []size  c.size :=     becomes>  p.coef                         211
    real n.wt1 c.size  -  ramp  becomes> u.t
    0.  u.t  :=
    p.coef  u.t  catenate
      c.size  2. /  floor neg  rotate
```

```
      p0.i                        rotate
      becomes> p.coef
  csq  abpq.con  *
    []size  c.size :=     becomes>  q.coef
    real n.wt1 c.size  -  ramp  becomes> u.t
    0.  u.t  :=
    q.coef  u.t catenate
      c.size  2. /  floor neg  rotate
      q0.i                        rotate
      becomes> q.coef
  csa  abpq.con  *
    []size  c.size :=     becomes>  a.coef
    real n.wt1 c.size  -  ramp  becomes> u.t
    0.  u.t  :=
    a.coef  u.t  catenate
      c.size  2. /  floor neg  rotate
      a0.i                        rotate
      becomes> a.coef
  csb  abpq.con  *
    []size  c.size :=     becomes>  b.coef
    real n.wt1 c.size  -  ramp  becomes> u.t
    0.  u.t  :=
    b.coef  u.t catenate
      c.size  2. /  floor neg  rotate
      b0.i                        rotate
      becomes> b.coef
;
\ ------------------------------------------
: get.h&g
  isign  -1  =
  if
    p.coef  q.coef
  else
    a.coef  b.coef
  then
  becomes> gt.t      becomes> ht.t
;
\ ============================================================
: get.h&g.bo
  wlet   3 1  "sub   wlet  4 1  "sub  "cat   tmp.s  ":=
  tmp.s  " 11"  "= if       bo11   then
  tmp.s  " 13"  "= if       bo13  then
  tmp.s  " 15"  "= if       bo15   then
  tmp.s  " 22"  "= if       bo22   then
  tmp.s  " 24"  "= if       bo24   then
  tmp.s  " 26"  "= if       bo26   then
  tmp.s  " 28"  "= if       bo28   then
  tmp.s  " 31"  "= if       bo31   then
  tmp.s  " 33"  "= if       bo33   then
  tmp.s  " 35"  "= if       bo35   then
  tmp.s  " 37"  "= if       bo37   then
  tmp.s  " 39"  "= if       bo39   then
  csp       rev[ 1 ]      becomes>  csb   \ b.o
      csb    []size c.size := drop
      c.size 1 +  1
```



```
      do
        csb    [ i ]    -1 i 1 - **   *    csb    [ i ] :=
      loop
  csa       rev[ 1 ]      becomes>  csq   \ b.o
      csq    []size c.size := drop
      c.size 1 +  1
      do
        csq    [ i ]    -1 i 1 - **   *    csq    [ i ] :=
      loop
  csp       becomes>   p.token     \  B.O. switch
  csq       becomes>   q.token
  csa       becomes>   a.token
  csb       becomes>   b.token
  wlet  5 1  "sub  " d"  "=
  if
    p.token  becomes>   csa          \ dual
    q.token  becomes>   csb
    a.token  becomes>   csp
    b.token  becomes>   csq
  else
    p.token  becomes>   csp
    q.token  becomes>   csq
    a.token  becomes>   csa
    b.token  becomes>   csb
  then
  wlet 3 1 "sub   " 1"  "=
  if
    csp      becomes> csp
    csq      becomes> csq
    csa      becomes> csa
    csb neg  becomes> csb
  then
  wlet 3 1 "sub   " 3"  "=
  if
    csp      becomes> csp
    csq neg  becomes> csq
    csa      becomes> csa
    csb      becomes> csb
  then
  wlet 3 1 "sub   " 2"  "=
  if
    wlet 5 1 "sub   " d"  "=
    if
      csq      becomes> csq
      csb neg  becomes> csb
    else
      csq neg  becomes> csq
      csb      becomes> csb
    then
  then
  get.abpq.size
  get.0.i.bo
  get.abpq
;
\ ------------------------------------------
```

```
: get.h&g.so                                                    326
  so3
  csp   []size    p.size :=   drop
  csq   []size    q.size :=   drop
  csa   []size    a.size :=   drop
  csb   []size    b.size :=   drop                              331

  csp       becomes>    p.token      \  B.O. switch
  csq       becomes>    q.token
  csa       becomes>    a.token
  csb       becomes>    b.token                                 336
  wlet  3 1   "sub   " d"    "=
  if
    p.token   becomes>    csa          \ dual
    q.token   becomes>    csb
    a.token   becomes>    csp                                   341
    b.token   becomes>    csq
  else
    p.token   becomes>    csp
    q.token   becomes>    csq
    a.token   becomes>    csa                                   346
    b.token   becomes>    csb
  then
  get.abpq.size
  get.0.i.so
  get.abpq                                                      351
;
\ ------------------------------------------------
: get.h&g.on.c \ Coiflet
  wlet    3 1   "sub    wlet   5 1   "sub   "cat    tmp.s ":=
  tmp.s   " 1c"   "= if        cc1     then                    356
  tmp.s   " 2c"   "= if        cc2     then
  tmp.s   " 3c"   "= if        cc3     then
  tmp.s   " 4c"   "= if        cc4     then
  tmp.s   " 5c"   "= if        cc5     then
  csp                                                           361
  []size   c.size :=      becomes>   csp
  c.size   p.size :=
  c.size   q.size :=
  c.size   a.size :=
  c.size   b.size :=                                            366

    csp      rev[ 1 ]       becomes>   csq
    c.size 1 +   1
    do
      csq     [ i ]     -1 i 1 - **    *     csq     [ i ] :=   371
    loop
    csp      rev[ 1 ] conj becomes>   csa
    csq      rev[ 1 ] conj becomes>   csb

    csp       becomes> csp                                      376
    csq neg   becomes> csq
    csa       becomes> csa
    csb neg   becomes> csb
```



```
  csp       becomes>    p.token                                 381
  csq       becomes>    q.token
  csa       becomes>    a.token
  csb       becomes>    b.token
  wlet   5 1   "sub   " s"    "=    \
  if                                                            386
    p.token              becomes>    csa          \ dual
    q.token              becomes>    csb
    a.token              becomes>    csp
    b.token              becomes>    csq
  then                                                          391
  get.abpq.size
  get.0.i.on.c
  get.abpq
;
\ ============================================================  396
\ ------------------------------------------------
: get.h&g.on
  wlet    3 1   "sub    wlet   5 1   "sub   "cat    tmp.s ":=
  tmp.s    " 1a"   "= if        dc1     then
  tmp.s    " 2a"   "= if        dc2     then                    401
  tmp.s    " 3a"   "= if        dc3     then
  tmp.s    " 4a"   "= if        dc4     then
  tmp.s    " 5a"   "= if        dc5     then
  tmp.s    " 6a"   "= if        dc6     then
  tmp.s    " 7a"   "= if        dc7     then                    406
  tmp.s    " 8a"   "= if        dc8     then
  tmp.s    " 9a"   "= if        dc9     then
  tmp.s    " 0a"   "= if        dc10    then
  tmp.s    " 4s"   "= if        dc4las     then
  tmp.s    " 5s"   "= if        dc5las     then                411
  tmp.s    " 6s"   "= if        dc6las     then
  tmp.s    " 7s"   "= if        dc7las     then
  tmp.s    " 8s"   "= if        dc8las     then
  tmp.s    " 9s"   "= if        dc9las     then
  tmp.s    " 0s"   "= if        dc10las    then                416

  []size   c.size :=      becomes>   csp
  c.size   p.size :=
  c.size   q.size :=
  c.size   a.size :=                                            421
  c.size   b.size :=

    csp      rev[ 1 ]       becomes>   csq
    c.size 1 +   1
    do                                                          426
      csq     [ i ]     -1 i 1 - **    *     csq     [ i ] :=
    loop
    csp      rev[ 1 ] conj becomes>   csa
    csq      rev[ 1 ] conj becomes>   csb
                                                                431
  csp       becomes>    p.token      \  B.O. switch
  csq       becomes>    q.token
  csa       becomes>    a.token
  csb       becomes>    b.token
```

```
  wlet  5 1  "sub  " s"   "=    \ least asy (las)
  if
    p.token             becomes>   csa          \ dual
    q.token             becomes>   csb
    a.token             becomes>   csp
    b.token             becomes>   csq
  then
  get.abpq.size
  get.0.i.on
  get.abpq
;
\ ================================================================
real scalar var
     scalar mea
token x.t  exp.mem> x.t
token t.t  exp.mem> t.t
: get.h&g.gaussian
  isign  :=
\  n.wt1 2. /  0.5 +  mea :=
\  n.wt1 var.frac /  var :=     \ var.frac ~ 10.
\  dp.real  n.wt1  ramp
  100   2. /  0.5 +  mea :=
  100   var.frac /  var :=     \ var.frac ~ 10.
  dp.real  100  ramp

  becomes> x.t

  x.t mea -  var /             \ Normalizing here
\  Don't do normalizing
\  mea  1 -  /                 \ Normalizing x
  1 *  becomes> t.t
  t.t dup *  neg
  2.  /
  exp
  2.  pi *  sqrt  /
  becomes> x.t

\   x.t []sum  tmp.v.9 :=
\   x.t tmp.v.9  /
\   becomes> x.t

  x.t
\ hanning.window.apply
       dup []sum   /
  becomes> x.t

  x.t
  []size 2 /     rotate
  becomes> ht.t      \
  x.t  t.t *  neg
\  tmp.v.9 /
  []size 2 /     rotate
  becomes> gt.t      \

\  gt.t
```



```
\  arrange.h&g
  isign  -1  =
  if
    ht.t
    c.size 2 /   2 -  neg  rotate
    c.size 2 /   rotate
    becomes> ht.t
    gt.t
    c.size 2 /   2 -  neg  rotate
    c.size 2 /   rotate
    becomes> gt.t
  then
;
\ ================================================================
: get.abpq.le&me
    p.coef \  u.t  catenate
      c.size  2 /          neg  rotate
      p0.i                      rotate
      becomes> p.coef
    q.coef \  u.t catenate
      c.size  2 /          neg  rotate
      q0.i                      rotate
      becomes> q.coef
    a.coef \  u.t  catenate
      c.size  2 /          neg  rotate
      a0.i                      rotate
      becomes> a.coef
    b.coef \  u.t catenate
      c.size  2 /          neg  rotate
      b0.i                      rotate
      becomes> b.coef
;
\ ------------------------------------------------
: abpq.from.freq
  hf.t  ifft  zreal
  rev[ 1 ]              \ important
  becomes>  p.coef
    p.coef  []size  c.size :=  drop
    p.coef  rev[ 1 ]       becomes>  q.coef
    c.size 1 +  1
    do
      q.coef [ i ]    -1 i 1 - **   *    q.coef [ i ] :=
    loop
    p.coef  rev[ 1 ] conj becomes>  a.coef
    q.coef  rev[ 1 ] conj becomes>  b.coef

  p.coef                becomes>   csa          \ dual
  q.coef                becomes>   csb
  a.coef                becomes>   csp
  b.coef                becomes>   csq
  get.abpq.size
  get.0.i.le&me
  get.abpq.le&me
;
\ ================================================================
```

```
dp.real scalar tmp.v                                                    546
dp.real scalar tmp.v.2
: nu.v
    tmp.v  abs   3.D *  pi / 2.D /  1.D -
    tmp.v.2  :=
    tmp.v.2  0  <=                                                      551
    if
      0.D
    else
      tmp.v.2   0.  >
      tmp.v.2   1  <=   and                                             556
      if
        tmp.v.2  4 **
        35.D   84.D  tmp.v.2 * -
        70.D tmp.v.2  2 ** * +  20.D tmp.v.2 3 ** * -
        *                                                               561
      else
        1.D
      then
    then
;                                                                       566
: phi.cap.v
  tmp.v :=
    tmp.v  abs   2.D  pi * 3.D /   <=
    if
      2.D  pi *  sqrt  inv                                              571
    else
      tmp.v  abs   2.D  pi * 3.D /   >
      tmp.v  abs   4.D  pi * 3.D /   <=   and
      if
        2.D  pi *  sqrt  inv                                            576
        pi   2.d /  nu.v  *
        cos  *
      else
        0.D
      then                                                              581
    then
;
\ ------------------------------------------------
: get.h&g.me
  rad                                                                   586
  dp.real  n.wt1   ramp
  n.wt1  c.size :=
  2.  Pi  *   *  n.wt1  /       \  2pi/N , 2pi*2/N,    , 2pi*N/n.fft.pts

  becomes> u.t                                                          591
  0  tmp.v.i :=
  begin
    tmp.v.i 1 +  tmp.v.i :=
    u.t [ tmp.v.i ]   0.D              +     2.D *   phi.cap.v
    u.t [ tmp.v.i ]   -1  2.D  pi * *  +     2.D *   phi.cap.v          596
    +  2  pi *  sqrt *
    2.D   sqrt  *
    u.t [ tmp.v.i ] :=
    tmp.v.i  n.wt1 =
```



```
  until                                                                 601
  u.t
  becomes> hf.t
  abpq.from.freq
;
\ ================================================================      606
: compu.le
  dup
  2.  /  sin   2. **            becomes> u.t
         sin   2. **            becomes> v.t
  u.t     1  *                  becomes> u.t                           611
  v.t     1  *                  becomes> v.t
  315.  420. u.t * -    126. u.t 2. **  *  +  4.  u.t 3. **  * -
  315.  420. v.t * -    126. v.t 2. **  *  +  4.  v.t 3. **  * -
  /
  2.  1. u.t -  4. **   *                                                616
  *
  z=x+i0   sqrt
;
: get.h&g.Le
  rad                                                                   621
  dp.real  n.wt1   ramp
  n.wt1  c.size :=
  2.  Pi  *   *  n.wt1  /       \  2pi/N , 2pi*2/N,    , 2pi*N/n.fft.pts
  compu.le
  becomes> hf.t                                                         626

  \  real  n.wt1   ramp
  \  2.  Pi  *   *  n.wt1  /          \  2pi/N , 2pi*2/N,    , 2pi*N/
     n.fft.pts
  \  Pi  +
  \  compu.le                                                           631
  \  conj
  \  real  n.wt1   ramp
  \  2.  Pi  *   *  n.wt1  /   neg
  \  dup   cos    swap    sin    z=x+iy
  \  *                                                                  636
  \  becomes> gf.t
  abpq.from.freq
;
\ ================================================================
: per.conv \  [ s , r --  (s*r <-> ) ]  \ Implementing periodic       641
   convolution
          \    n   m                   \
    fft
    swap
    fft
    *                                                                   646
    ifft zreal
;
: aper.conv \ [ s , r --  (s*r <-> ) ]  \ Implementing periodic
   convolution
          \   n   m                   \
  []size  im  :=    becomes>  a2.t       \ response function in length  651
     of m
```

```
  []size  in  :=    becomes>  a1.t
  domain.flag  0 =
  if                                        \ From Time domain
    in  im   >                                                          656
    if
      im  2  modulo   0  =
      if                                      \ Make it into odd
        a2.t   0.   catenate   becomes>  a2.t
      then                                                              661
    then
    a2.t  []size  im  :=  drop
\    a1.t            becomes>  a3.t         \ Response function in length
    of n
\
\    0.   a3.t  :=                          \ Padding and wrapping        666
\    a2.t   a3.t  sub[ 1 , im ]  :=

\    isign 1 =                              \ No need to wrap for inverse
    WT
\    in   im >  and                         \ Need to wrap for forward WT
\    if                                                                 671
\          a3.t  im 1 -  2 /  neg  rotate  becomes> a3.t
\    then
\    a3.t  1 *  becomes> a3.t
  then
  a1.t  a2.t  rev[ 1 ]   conv.aper                                      676
\  sub[   1   ,  in  ]
\  a1.t  a2.t     conv.aper
  sub[ im  2 /  1 +  ,  in  ]
;
\ ================================================================      681
: assign.wlet
  wlet  2  "left   " me"    "=    if   get.h&g.me  then  \ o.n.
  wlet  2  "left   " le"    "=    if   get.h&g.le  then  \ o.n.
\ wlet  2  "left   " on"    "=    if   get.h&g.on  then
  wlet  2     "left   " on"    "=                                       686
  wlet  5  1  "sub    " a"     "=
  wlet  5  1  "sub    " s"     "=  or  and
                                 if   get.h&g.on  then
  wlet  2     "left   " on"    "=
  wlet  5  1  "sub    " c"     "=  and                                  691
                                 if   get.h&g.on.c  then
  wlet  2  "left   " bo"    "=    if   get.h&g.bo  then
  wlet  2  "left   " so"    "=    if   get.h&g.so  then
;
\ ================================================================      696
: make.awp.t \ [ at.t -- ]
  n.wt1  my.power
  10  n.power >=
  if
    real                                                                701
  else
    dp.real
  then
```



```
  n.wt1  ramp
  dup                                                                   706
  1  tmp.v.i :=
  begin
    tmp.v.i  1 +  tmp.v.i :=
    dup
    rot                                                                 711
    laminate
    swap
    \  tmp.v.i  n.power =
    tmp.v.i  n.power  1 + =
  until                                                                 716
  drop
  becomes> awp.t
;
\ ------------------------------------------------
: make.at.t.INV \ [ u.t -- ]                                            721
  jwp  n.power  <
  if
    0  tmp.v.i  :=
    begin
      tmp.v.i  1 +   tmp.v.i  :=                                        726
      dup  catenate
      tmp.v.i  kwp 1 +  =
    until
    becomes> at.t
  else                                                                  731
    becomes> at.t
  then
;
\ ------------------------------------------------
: get.jwp_m                                                             736
  jwp        0  =
  if     n.power 1 +    jwp_m :=
  else   jwp            jwp_m :=
  then
;                                                                       741
\ ------------------------------------------------
: get.swp.t \ inverse wavelet packet transform
  0  at.t :=           \  Combine the top level of each WP block
  n.power   jwp :=     \    into a {S D1 D2 ....Dj} array
  begin                                                                 746
    jwp 1 -   jwp :=
    get.jwp_m
    awp.t  xsect[ jwp_m , ! ] sub[ 2  jwp ** 1 +  , 2 jwp ** ]
    at.t                      sub[ 2  jwp ** 1 +  , 2 jwp ** ] :=
    jwp  jwp.level 1 +  =                                               751
  until

  jwp.level  0  =
  if
    awp.t  xsect[ jwp_m     , ! ] sub[ 1 , 2  jwp.level 1 + ** ]       756
  else
    awp.t  xsect[ jwp.level , ! ] sub[ 1 , 2  jwp.level 1 + ** ]
  then
```

```
  at.t                              sub[ 1 , 2  jwp.level 1 + ** ] :=
  at.t  becomes>  bwp.t                                                  761

  jwp.level          jwp :=
  jwp 1 -            nn  :=
  n.power 1 - jwp -  kwp :=
  at.t   sub[ 1              ,  2  jwp **    ]    becomes>  s.t          766
  at.t   sub[ 2  jwp ** 1 +                  ]    becomes>  d.t

  begin
    jwp 1 +  jwp :=
    nn  1 +  nn  :=                                                      771
    kwp 1 -  kwp :=
    get.jwp_m
    {tmp.wnd}
    2 0 fix.format
    cr ."        ===> INV WP Scale Form (" jwp.level . ."  --->"         776
       n.power .
       ." ) "  ." J = "  jwp .
    4 0 fix.format

    s.t  dup    catenate    dup  becomes>  u.t    \ set proper dim
                                 becomes>  s.t                           781

    0.  u.t   :=   \ upsampling
    s.t  sub[  1 ,  2 nn ** ]    u.t  sub[ 1 , 2 nn ** , 2 ]  :=
         u.t   make.at.t.inv
         at.t                                                            786
         ht.t  per.conv             \   for inverse WT
         sub[  1    ,   2 nn  1 + **  ]

    0.  u.t   :=
    d.t  sub[  1 ,  2 nn ** ]    u.t  sub[ 1 , 2 nn ** , 2 ]  :=        791
         u.t   make.at.t.inv
         at.t
         gt.t  per.conv
         sub[  1    ,   2 nn  1 + **  ]
                                                                         796
    +   becomes> s.t
    \ ------------------------------------------
    jwp  n.power  <
    if
      d.t  sub[ 2  nn **  1 +  ]    becomes>   d.t                       801
    then
    jwp  n.power  =
  until
  s.t
  \ dup                                                                  806
  awp.t sub[ n.power , 1 ; 1 , 2 n.power ** ]  :=
;
\ ================================================================
token norm.l  exp.mem> norm.l
token norm.v  exp.mem> norm.v                                            811
real    scalar  norm.keep.p
dp.real scalar  norm.keep.sum.v
```



```
token norm.v.s  exp.mem> norm.v.s  \ best level (single level)
integer scalar ic.least
integer scalar best.level                                                816

\ 80.  100. /   norm.keep.p :=
: norm.wp.best
  norm.keep.p.best  norm.keep.p :=
  n.wt1  my.power                                                        821
  \ ----------------------- best level -------------------------
  jwp.level  best.level  :=
  jwp.level    1 -   jwp :=
  n.power 1 - jwp -  kwp :=
  get.jwp_m                                                              826
  begin
    jwp 1 +  jwp :=
    kwp 1 -  kwp :=
    get.jwp_m
       awp.t  xsect[ jwp_m  , ! ]                                        831
         dup *  sort   rev[  1 ]    ^sum
         dup [ 2 n.power ** ] norm.keep.p *    norm.keep.sum.v :=
         0  tmp.v.i :=
         begin
           tmp.v.i 1 +  tmp.v.i :=                                       836
           dup  [ tmp.v.i ]          norm.keep.sum.v  >
           tmp.v.i                   2 n.power **     =
           or
         until
         drop                                                            841
         tmp.v.i       icd :=
         jwp  jwp.level =
         if
           icd ic.least :=
         then                                                            846

      awp.t  xsect[ jwp 1 +     , ! ]
        dup *  sort   rev[  1 ]    ^sum
        0  tmp.v.i :=
        begin                                                            851
          tmp.v.i 1 +  tmp.v.i :=
          dup  [ tmp.v.i ]          norm.keep.sum.v  >
          tmp.v.i                   2 n.power **     =
          or
        until                                                            856
        drop
        tmp.v.i       icu :=

      icu  icd <
      icu  ic.least < and                                                861
      if
        icu   ic.least  :=
        cr " Find New Level at "  jwp 1 +  0 n>s "cat
        "type
        "    " icu 0 n>s  "cat  " <" "cat  icd 0 n>s "cat  "type         866
        jwp 1 +   best.level  :=
      else
```

```
    then
  jwp  n.power 1 - =
until                                                              871
best.level 0 =
if
  awp.t  xsect[ n.power 1 + , ! ]   becomes> norm.v.s
else
  awp.t  xsect[ best.level , ! ]   becomes> norm.v.s               876
then

\ ------------------------ best basis --------------------------
n.wt1  integer ramp  becomes> norm.l
n.wt1  dp.real ramp  becomes> norm.v                               881
jwp.level          jwp :=
n.power 1 - jwp -  kwp :=
get.jwp_m
jwp.level                              norm.l :=
awp.t  xsect[ jwp_m  , ! ]   becomes>  norm.v                      886
\ awp.t  xsect[ jwp_m  , ! ]   norm.v :=

1 to.123.999.flag =
if
  wlet  n.power 0 n>s  "cat " -->" "cat  jwp.level 0 n>s "cat  "  | p=  891
     " "cat
  norm.keep.p -3 n>s "cat
  1 row.no :=
  to.123.999
then
begin                                                              896
  jwp 1 +  jwp :=
  kwp 1 -  kwp :=
  get.jwp_m
  -1       mwp :=
  begin                                                            901
    mwp 1 +   mwp :=
    norm.v
      sub[   mwp 2 jwp      ** * 1 + , 2 jwp ** ]
      dup *  sort   rev[  1 ]    ^sum
      dup [ 2 jwp ** ] norm.keep.p *    norm.keep.sum.v :=           906
      0  tmp.v.i :=
      begin
        tmp.v.i 1 +  tmp.v.i :=
        dup  [ tmp.v.i ]          norm.keep.sum.v  >
        tmp.v.i                   2 jwp **         =               911
        or
      until
      drop
      tmp.v.i  2 jwp ** =
      if                                                           916
        tmp.v.i       icd :=
      else
        tmp.v.i       icd :=
      \ tmp.v.i 1 -   icd :=
      then                                                         921
```



```
      awp.t  xsect[ jwp_m       , ! ]
        sub[   mwp 2 jwp      ** * 1 + , 2 jwp ** ]
        dup *  sort   rev[  1 ]    ^sum
        \ dup [ 1 ]  norm.keep.p *    norm.keep.sum.v :=            926
        0  tmp.v.i :=
        begin
          tmp.v.i 1 +  tmp.v.i :=
          dup  [ tmp.v.i ]          norm.keep.sum.v  >
          tmp.v.i                   2 jwp **         =             931
          or
        until
        drop
        tmp.v.i  2 jwp ** =
        if                                                         936
          tmp.v.i       icu :=
        else
          tmp.v.i       icu :=
        \ tmp.v.i 1 -   icu :=
        then                                                       941
      icu  icd <
      if
        \ cr ." Find at (J,M)=("  jwp  .  mwp .  ." )"
        cr " Find at (J,M)=("  jwp 0 n>s "cat
        " , " "cat  mwp 0 n>s "cat  " )" "cat                      946
        "type
        1 to.123.999.flag =
        if
          "    " icu 0 n>s  "cat  " <" "cat  icd 0 n>s "cat  "type
          " ("  jwp 0 n>s "cat                                     951
          " ," "cat  mwp 0 n>s "cat  " )" "cat
          to.123.999
        then
        jwp
        norm.l sub[   mwp 2 jwp      ** * 1 + , 2 jwp ** ] :=     956
        awp.t  xsect[ jwp_m       , ! ]
               sub[   mwp 2 jwp      ** * 1 + , 2 jwp ** ]
        norm.v sub[   mwp 2 jwp      ** * 1 + , 2 jwp ** ] :=
      else
      then                                                         961
      mwp    2 kwp 1 + ** 1 -  =
    until
    jwp  n.power 1 - =
  until
;                                                                  966
\ ================================================================
: inverse.wt \ [ at.t   h(summing)   g(differencin) -- swt.t ]
\ 2  jwp.level :=    \ range from 1 to (n.power-1)
  sub[ 1 , n.wt1 ]
  1 *                                                              971
  becomes> at.t
  assign.wlet
  -1  isign   :=
  get.h&g     \ get correct sign
                                                                   976
  n.wt1  my.power
```

```
make.awp.t
jwp.level           jwp :=
jwp 1 -             nn  :=                                          981
n.power 1 - jwp -   kwp :=
get.jwp_m

at.t    sub[ 1 , n.wt1 ]  awp.t  sub[ jwp_m ; 1 , 2 n.power ** ]  :=
at.t    sub[ 1              ,  2  jwp **    ]    becomes>  s.t      986
at.t    sub[ 2  jwp ** 1 +                 ]    becomes>  d.t

dp.real.fft

begin                                                               991
  jwp 1 +  jwp :=
  nn  1 +  nn  :=
  kwp 1 -  kwp :=
  get.jwp_m
  {tmp.wnd}                                                         996
  2 0 fix.format
  cr ."        ===> INV Scale Form (" jwp.level . ."  --->"  n.power .
     ." ) "  ." J = "  jwp .
  4 0 fix.format
                                                                    1001
  s.t  dup    catenate    dup  becomes>  u.t    \ set proper dim
                          dup  becomes>  uwp.t
                          dup  becomes>  vwp.t
                          dup  becomes>  swp.t
                               becomes>  s.t                        1006

  0.  u.t   :=   \ upsampling
  s.t  sub[  1 ,  2 nn ** ]    u.t  sub[ 1 , 2 nn ** , 2 ]  :=
       u.t   make.at.t.inv
       at.t                                                         1011
       ht.t  per.conv             \   for inverse WT
       sub[  1    ,   2 nn  1 + **  ]

  0.  u.t   :=
  d.t  sub[  1 ,  2 nn ** ]    u.t  sub[ 1 , 2 nn ** , 2 ]  :=     1016
       u.t   make.at.t.inv
       at.t
       gt.t  per.conv
       sub[  1    ,   2 nn  1 + **  ]
                                                                    1021
  +   becomes> s.t
  \ ------------------------------------------
  wp.flag  1 =
  if
  \ ------------------------------------------                     1026
  s.t                  awp.t sub[ jwp_m , 1  ; 1 , 2  jwp      ** ] :=
  \ jwp from (jwp.level + 1 --> n.power )

  jwp  n.power <
  if                                                                1031
    0  mwp :=
```



```
      ."  WP(" 2 kwp 1 + ** 1 -  n.type ." trees)"
      {29.line}  sc
      begin
        mwp 1 +  mwp :=                                             1036
        mwp  .

        0.  uwp.t :=
        0.  vwp.t :=
        jwp  1  >                                                   1041
        if
          jwp_m 1 -   tmp.v.i.2 :=
        else
          jwp_m       tmp.v.i.2 :=
        then                                                        1046
        awp.t  xsect[ tmp.v.i.2  , ! ]
               sub[   mwp 2 jwp     ** * 1 + , 2 jwp 1 - ** ]
               uwp.t  sub[ 1 , 2 nn ** , 2 ]  :=
        awp.t  xsect[ tmp.v.i.2 , ! ]
               sub[   mwp 2 jwp     ** * 1 +                        1051
                      2 jwp 1 - **      + , 2 jwp 1 - ** ]
               vwp.t  sub[ 1 , 2 nn ** , 2 ]  :=

        uwp.t  make.at.t.inv
               at.t                                                 1056
               ht.t  per.conv             \   for inverse WT
               sub[  1    ,   2 nn 1 +  **  ]
        vwp.t  make.at.t.inv
               at.t
               gt.t  per.conv             \   for inverse WT       1061
               sub[  1    ,   2 nn 1 +  **  ]
        +      becomes>  swp.t
        swp.t
        \   awp.t sub[ jwp , 1  ; mwp 2 jwp     ** * 1 + , 2 jwp     **
           ] :=
            awp.t sub[ jwp_m , 1  ; mwp 2 jwp     ** * 1 + , 2 jwp    1066
               ** ] :=
        mwp  2  kwp 1 + **  1 -   =
      until
    then

    then                                                            1071
    \ ----------------------------------------

    jwp  n.power  <
    if
      d.t  sub[ 2  nn **  1 +  ]    becomes>   d.t                   1076
    then
    jwp  n.power  =
  until
  s.t  becomes> swt.t
  wp.flag  1 =                                                      1081
  if
    get.swp.t
  then
  s.t  becomes> swp.t
```

```
  swt.t                                                                    1086
;
\ ================================================================
: forward.wt \ [ at.t , ht.t , gt.t  -- ]
  sub[ 1 , n.wt1 ]
  1 *                                                                      1091
  becomes> at.t
  assign.wlet
  +1  isign  :=
  get.h&g      \ get correct sign
  n.wt1  my.power                                                          1096

  make.awp.t
  n.power  jwp :=
  -1       kwp :=
  0        nn  :=                                                          1101
  at.t  sub[ 1 , n.wt1 ]  awp.t  sub[ jwp ; 1 , 2 jwp ** ]  :=
  begin
    nn  1 +  nn  :=
    kwp 1 +  kwp :=
    jwp 1 -  jwp :=                                                       1106
    get.jwp_m
    {tmp.wnd}
    2 0 fix.format
    cr ."         ===> FWR Scale From (" n.power . ." -->" jwp.level .
       ." ) "  ." J = "  jwp .                                            1111
    4 0 fix.format
    at.t   ht.t
    aper.flag  1  =
    if  "  >a" s.type  aper.conv
    else  per.conv     then                                               1116
    c.size 2 /  2  modulo  0 =
    if
      sub[           1    , n.wt1  2 nn ** / ,  2 ]  becomes> u.t
    else
      sub[           1    , n.wt1  2 nn ** / ,  2 ]  becomes> u.t         1121
    then
    at.t   gt.t
    aper.flag  1  =
    if   " >a" s.type  aper.conv
    else  per.conv     then                                               1126
    c.size 2 /  2  modulo  0 =
    if
      sub[           1    , n.wt1  2 nn ** / ,  2 ]  becomes> v.t
    else
      sub[           1    , n.wt1  2 nn ** / ,  2 ]  becomes> v.t         1131
    then
    \ ---------------------------------
    wp.flag  1 =
    if
    \ ---------------------------------                                   1136
    u.t  v.t  catenate  awp.t sub[ jwp_m , 1  ; 1 , 2  jwp 1 + ** ] :=
    jwp  n.power 1 - <
    if
      0  mwp :=
```



```
      ."  WP(" 2 kwp ** 1 -  .  ." )"                                     1141
      {29.line}  sc
      begin
        mwp 1 +  mwp :=
        mwp  .
        awp.t sub[ jwp   1 + , 1 ; mwp 2 jwp 1 + ** * 1 + , 2 jwp 1 + **  1146
            ]
        \ jwp from (n.power-1 --> jwp.level)
        0 tmp.v.i :=
        begin
          dup catenate
          tmp.v.i 1 +  tmp.v.i :=                                         1151
          tmp.v.i  kwp =
        until
        dup
        ht.t  per.conv
        sub[   1    , n.wt1  2 nn ** / ,  2 ]  becomes> uwp.t             1156
        gt.t  per.conv
        sub[   1    , n.wt1  2 nn ** / ,  2 ]  becomes> vwp.t
        uwp.t  vwp.t  catenate
        awp.t sub[ jwp_m , 1 ; mwp 2 jwp 1 + ** * 1 + , 2 jwp 1 + ** ]
           :=
        mwp  2  kwp **  1 -   =                                           1161
      until
    then

    then
    \ ---------------------------------                                   1166
    jwp  n.power 1 -  =
    if
      v.t                  becomes> d.t
    else
      v.t  d.t  catenate  becomes> d.t                                    1171
    then
    0  tmp.v.i  :=
    u.t
    begin
      tmp.v.i  1 +   tmp.v.i  :=                                          1176
      dup  catenate
      tmp.v.i  nn  =
    until
    becomes> at.t
    jwp  jwp.level =                                                      1181
  until
  u.t  d.t  catenate      becomes> d.t
  d.t          becomes> swt.t
  wp.flag  1 =
  if                                                                      1186
    jwp.level  0  =
    if
      awp.t xsect[ n.power 1 +  , ! ]
    else
      awp.t xsect[ jwp.level , ! ]                                        1191
    then
    dup         becomes> swp.t
```

```
  else
    d.t
  then                                                                1196
;
\ ================================================================
: aper.wt.convo \ [ at.t , ht.t , gt.t  -- ] use "a"
  becomes> gt.t
  becomes> ht.t                                                       1201
  becomes> at.t
  n.wt1  my.power
  1   nn  :=
  begin
    cr ." --- " nn  .                                                 1206
    \   at.t   ht.t         conv.aper(fft)
    at.t   ht.t             conv.aper
    sub[ im 1 - 2 / 2 +  , n.wt1  2 nn ** / ,  2 ]  becomes> u.t
    \   at.t   gt.t         conv.aper(fft)
    at.t   gt.t             conv.aper                                 1211
    sub[ im 1 - 2 / 2 +  , n.wt1  2 nn ** / ,  2 ]  becomes> v.t
    nn  1  =
    if
      v.t                  becomes> d.t
    else                                                              1216
      v.t  d.t  catenate  becomes> d.t
    then
    1  tmp.v.i  :=
    u.t
    begin                                                             1221
      dup  catenate
      tmp.v.i  1 +   tmp.v.i  :=
      tmp.v.i  nn  >
    until
    becomes> at.t                                                     1226
    nn  1 +  nn :=
    nn  n.power 1 -    >
    \    1  1 =
  until
  u.t  d.t  catenate       becomes> at.t                              1231
  at.t
;
: my.wt
  isign   1 =
  if   forward.wt                                                     1236
  else inverse.wt
  then
;
\ ================================================================
: my.wt.multi.bat                                                     1241
  tmp.s       ":=  \ window.type
  becomes> gt.t
  becomes> ht.t
  tmp.v.i.9    :=  \ #.sec
  tmp.v.i.1    :=  \ #.fft.pts                                        1246

  tmp.v.i.9   1   >
```



```
  if
    []size    tmp.v.i :=
    tmp.v.i   tmp.v.i.1  /  2 *    1 -     tmp.v.i.2  :=             1251
    tmp.v.i   tmp.v.i  tmp.v.i.1  /  tmp.v.i.1 *    -
    tmp.v.i.1  2 /
    >
    if
      tmp.v.i.2 1 +   tmp.v.i.2 :=                                    1256
    then
    tmp.v.i.2  tmp.v.i.9 >
    if
      tmp.v.i.9  tmp.v.i.2 :=
    then                                                              1261
  then

  tmp.v.i.2   1  >
  if
    2  tmp.v.i.3    :=                                  \  with       1266
       overlap
\   tmp.v.i.3  tmp.v.i.2  *    tmp.v.i.2   :=
    1  abs.flag :=
  else
    1  tmp.v.i.3    :=                                  \  no
       overlap
  then                                                                1271

  0                   \ initial sum
  swap                \ --> 0 , array

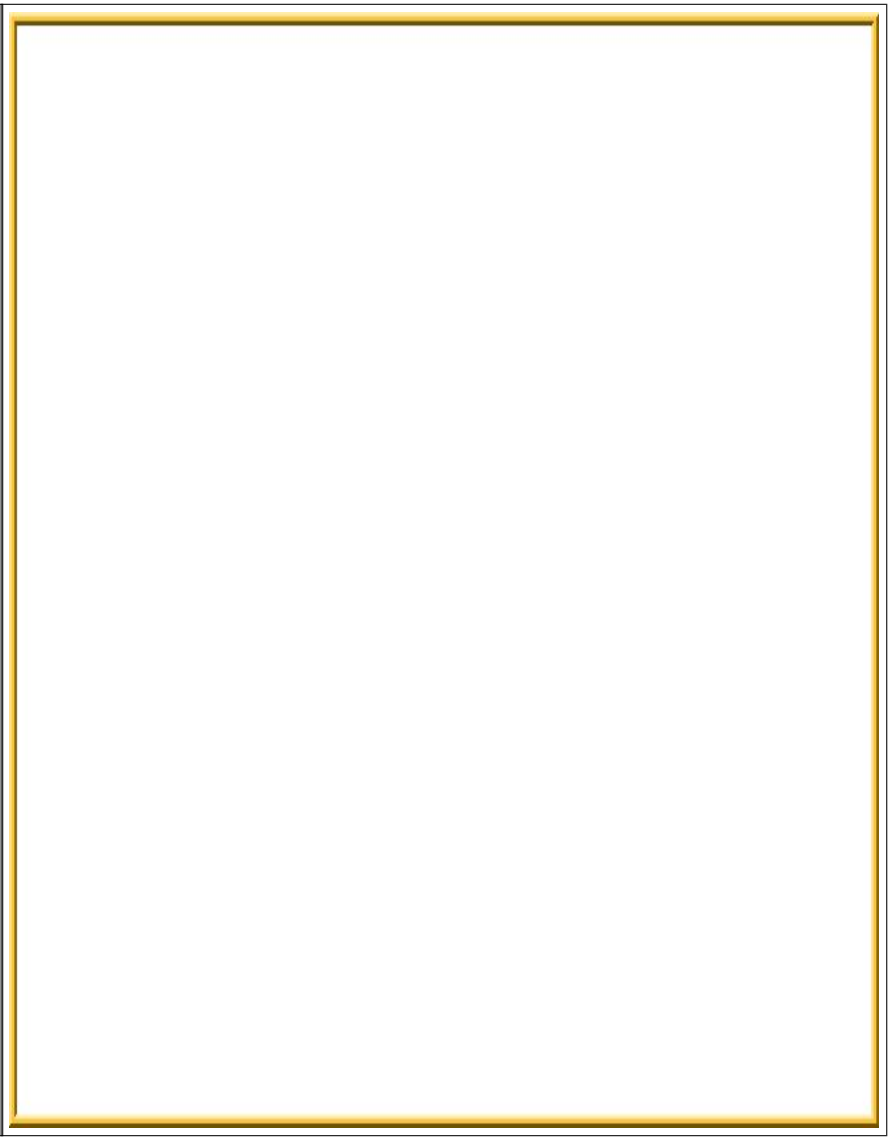
  tmp.v.i.2  1 +   1                                                  1276
  do
    cr " F----M.Sec:" s.type i .
    dup
    sub[ i 1 -    tmp.v.i.1  tmp.v.i.3 /   *    1 +   , tmp.v.i.1 ]
    tmp.s " x" "=  tmp.s  " X"  "=  or if                       then  1281
    tmp.s " k" "=  tmp.s  " K"  "=  or if   blackman.window.apply  then
    tmp.s " b" "=  tmp.s  " b"  "=  or if   bartlett.window.apply  then
    tmp.s " n" "=  tmp.s  " N"  "=  or if   hanning.window.apply   then
    tmp.s " m" "=  tmp.s  " M"  "=  or if   hamming.window.apply   then
    ht.t  gt.t      my.wt                                             1286

    abs.flag  1 =
    if
      abs
    then                                                              1291
    rot  \ --> array , p_s , 0
    +
    swap
  loop
  drop                                                                1296
  tmp.v.i.2  /
;
: my.wt.multi \ [ array , sec_size , sections , window_type -- p.s.array
  ]
  cr " [ array , fft.pts , #.sec , ht.t , gt.t -- abs_w_c ]" s.type
```

```
  my.wt.multi.bat                                                    1301
;
\
  ------------------------------------------------------------------------

\ ========================================================================

.....................................................................................................
```



LLet-Nor.asy

A01768-20161209-A022 ❖ December 9, 2016 ❖ [Page count: 5]

```
: LLet-Nor.asy ; \ %----- Asyst Prog                                        1

real dim[ 29 ]  array  n.k.p.a
integer scalar icp  scalar sec.level  scalar #.ele  scalar filter.flag
        scalar exp.flag               scalar i.beg
token sig.t  exp.mem> sig.t                                               6

n.k.p.a  @[ 1 ] enter[
.995 , .990 , .985 , .980 , .975 ,
.965 , .950 , .925 , .900 , .875 ,
.850 , .825 , .800 , .775 , .750 ,                                        11
.700 , .650 , .600 , .550 , .500 ,
.450 , .400 , .350 , .300 , .250 ,
.200 , .150 , .100 , .050        ] drop

real scalar s.freq.keep  scalar p.b.e  scalar t.w                        16
: get.sub.a
  exp.flag 2 =
  if
    sub[ i.beg 2 n.power 1 - ** i.inc * - , 2  n.power 1 + ** , i.inc ]
  else                                                                    21
    sub[ i.beg                          , 2  n.power     ** , i.inc ]
  then
  s.freq.keep  float  i.inc float  /  s.freq :=
  1 filter.flag =
  if                                                                      26
    use.blackman.window
    s.freq  filter.sample.rate
    lowpass[ p.b.e , t.w ]
    filter
  then                                                                    31

  \  s.freq  float  i.inc float  /  s.freq :=
  \  200  float  i.inc float  /  s.freq :=
;                                                                         36

: norm.wt&wp \ statistics of percentage needed to have power beyond
  becomes> tmp.t
  n.k.p.a  becomes>  123.ary.n
  tmp.t []size  swap drop  my.power
  \ n.power      sec.level :=                                             41
  sec.level          jwp :=
  \  cr ." sec.level:"  n.power get.val  sec.level :=
  n.power 1 - jwp -  kwp :=
  get.jwp_m
    \    jwp 1 +  jwp :=                                                 46
    \    kwp 1 -  kwp :=
    get.jwp_m

    0     icp :=
    begin                                                                 51
      icp  1 +  icp :=
```



```
      3 0 fix.format
      icp  n.type
      n.k.p.a [ icp ]    norm.keep.p :=
        jwp  n.power =                                                    56
        if
          2 jwp      **  #.ele :=
          0              mwp   :=
        else
          2 jwp 1 - **  #.ele :=                                          61
          1             mwp   :=
        then
    tmp.t   sub[   mwp   2 jwp      ** * 1 + , #.ele ]
        dup *  sort   rev[  1 ]     ^sum
        dup becomes> t8                                                   66
        dup [  #.ele   ]  norm.keep.p *    norm.keep.sum.v :=
        0  tmp.v.i :=
        begin
          tmp.v.i 1 +  tmp.v.i :=
          dup  [ tmp.v.i ]          norm.keep.sum.v  >                    71
          tmp.v.i                   #.ele            =
          or
        until
        drop
        tmp.v.i  #.ele    =                                               76
        if
          tmp.v.i       icd :=
        else
        \ tmp.v.i 1 -   icd :=
          tmp.v.i       icd :=                                          81
        then
        icd       float
        #.ele     float /
        100. *    \ in percentage
        123.ary.n  [ icp ] :=                                             86

      icp   n.k.p.a []size  swap drop  =
    until
    10 5 fix.format
;                                                                         91
: get.lab
  normal.coords  .5  .05  position
  wlet      "upper
  centered.label
  world.coords                                                            96
;
: get.lab.wp
  normal.coords  .5  .05  position
  wlet
  wp.flag 1 = if  " --- WP Best Basis"  "cat then                         101
  centered.label
  world.coords
;
: norm.bat
  \  wlet " -" "cat  sec.level 0 n>s  "cat                               106
  now.file " [" "cat
```

```
  sec.level 0 n>s "cat " ," "cat  jwp.level 0 n>s "cat  " ]" "cat
  123.ary.s "[ 1 ] ":=
  dir.lee.asc  now.file      "cat   ftoa.bat
  get.sub.a                                                          111

  dup becomes> sig.t
  dup
  forward.wt
  hp                                                                 116
  up 1 yap
  get.lab
  dp 1 yap
  get.lab
                                                                     121
  \ norm.keep.p.best  norm.keep.p :=
  norm.wp.best  \ get norm.v and norm.l
  swt.t
  norm.wt&wp
  to.123.1                                                           126

  wp.flag 1 =
  wlet  " le"  "=
  wlet  " me"  "=  or
  wlet  1 2 "sub  " on"  "=  or                                      131
  and
  if
    norm.v
    norm.wt&wp
    gd hp                                                            136
    up norm.l 1 yap  get.lab.wp
    dp norm.v 1 yap  get.lab.wp
    123.ary.s "[ 1 ]  " -" "cat  best.level 0 n>s  "cat  123.ary.s "[ 1
       ] ":=
    to.123.2
  then                                                               141
  file.ext make.abc
  2 sec.level **   0 n>s  123.ary.s "[ 1 ] ":=
  n.k.p.a  becomes>  123.ary.n \ for the additional col ( n.k.p.a )
;
\ ================================================================    146

: test.total.energy
  b  2 n.power **  999 " x" my.p.s
  \  2 n.power **  *  \ error <- from density to total energy
  []sum                                                              151
  " on22a" wlet ":=
  10 5 fix.format   .
  b  forward.wt
  dup *
  []sum                                                              156
  10 5 fix.format .
;

: lab.line.seq.res
  normal.coords                                                      161
```



```
  tmp.v.i 0 n>s  tmp.v.i 1 +  20. /   0.05 position
  tmp.v.i line.type label
                 tmp.v.i 2 +  20. /   0.05 position
  world.coords
;                                                                    166

: lab.line.seq \ [ tmp.v.i -- ]   [ "str -- ]
  "dup "null  "=
  if
    dup  0 n>s  "swap  "drop                                         171
  else
  then
  dup    dup
  normal.coords
                        1 +  20. /   0.05 position                   176
          line.type label
                        2 +  20. /   0.05 position
  world.coords
;
: plot.per.res                                                       181
  n.wt1  my.power
  norm.v               dup  * sort ^sum  12  yap
  12  " Best Basis"  lab.line.seq
  jwp.level 0 =
  if                                                                 186
    0 tmp.v.i :=
    1 tmp.v.i.2 :=
    awp.t xsect[ n.power 1 + , ! ] dup  * sort ^sum  tmp.v.i  ydp
    tmp.v.i "null lab.line.seq
  else                                                               191
    jwp.level 1 -  tmp.v.i :=
  then
  begin
    tmp.v.i 1 +  tmp.v.i :=
    awp.t xsect[ tmp.v.i , ! ] dup  * sort ^sum                      196
    tmp.v.i
    tmp.v.i.2  1 =
    if
      ydp
    else                                                             201
      yap
    then
    tmp.v.i "null lab.line.seq
    tmp.v.i  n.power =
  until                                                              206
;

: 123.tmp
  {29.line}
  dup [ 2 n.power ** ] /                                             211
  dup  becomes> 123.ary.n
  tmp.v.i  0 n>s  " -" "cat  wlet "cat  now.file "cat 123.ary.s "[ 1 ]
     ":=
  to.123
  file.no 1 + file.no :=
```

```
  previous.window                                                    216
;
: plot.per
  1 file.no :=
  1 gp.flag :=
  \ make sure this .wks exist                                        221
  dir.lee.asc   " norm-dis.wks" "cat   123.file.name   ":=
  n.wt1  my.power
  jwp.level 0 =
  if
    0 tmp.v.i :=                                                     226
    1 tmp.v.i.2 :=
    awp.t xsect[ n.power 1 + , ! ] dup  * sort ^sum
    123.tmp
    tmp.v.i  yap
    tmp.v.i "null lab.line.seq                                       231
  else
    0 tmp.v.i.2 :=
    jwp.level 1 -  tmp.v.i :=
  then
  begin                                                              236
    tmp.v.i 1 +  tmp.v.i :=
    awp.t xsect[ tmp.v.i , ! ] dup  * sort ^sum
    123.tmp
    tmp.v.i
    tmp.v.i.2  1 =                                                   241
    if
      ydp
      1 tmp.v.i.2 :=
    else
      yap                                                            246
    then
    tmp.v.i "null lab.line.seq
    tmp.v.i  n.power =
  until
  norm.v                dup  * sort ^sum                           251
  123.tmp
  13  ydp
  13  " Best Basis"  lab.line.seq
  2 n.power **  real ramp   2 n.power ** /
  123.tmp                                                            256
  swt.t                 dup  * sort ^sum
  123.tmp
  16  ydp
  16  " swt.t"       lab.line.seq
;                                                                    261
```

LLet-Pha.asy

A01769-20161209-A023 ❖December 9, 2016❖ [Page count: 2]

```
: LLet-Pha.asy ; \ %----- Asyst Prog                                    1

\ input llet-0.txt first

integer scalar #.wei
real scalar band.start  scalar band.stop                               6

1.1    band.start  :=
25     #.wei       :=
: fre.mod
  " [ array , freq , Hilbert.filter.flag  --  array ]" s.type          11
  tmp.v.i    :=
  tmp.v      :=
  becomes> t8

  tmp.v   2. /   band.start -   band.stop :=                           16
  t8
  dup
  tmp.v.i  1  =
  if
    tmp.v   filter.sample.rate                                         21
    hilbert[ #.wei ; band.start , band.stop ]
    ." epsilon="  n.type
    filter
  else
    hilbert                                                            26
  then
  \  neg
  swap  z=x+iy
  \ becomes> t7  t7 becomes> t8
  becomes> t8                                                          31

  \ Calcute dp/dt  --- use polar z=r*exp(i p)
  t8   differentiate.data                          \ dz
  t8   zmag   differentiate.data                   \ dr
  t8   zarg   dup   cos   swap   sin  z=x+iy  *    \ exp(i p) * dr     36
  -                                                \ --> numerator
  t8     0 1 z=x+iy  *                             \ i * z -->
     denomenator
  /

  \ zmag                                           \ Wrong             41
  zreal                                            \ Yes
  tmp.v   0  =
  if
  else
    2. pi *   /      tmp.v  *       \ change unit from radian to       46
       frequency
  then
  becomes> t8   \ fre.modu
  t8
;
```



```
                                                                       51
: m0.s.phase
  b inverse.wt 1 yap
  wlet tmp.s.u ":=
  tmp.s.u "upper  123.ary.s "[ 1 ] ":=
  p.coef fft zarg  becomes> 123.ary.n                                  56
\ q.coef fft zarg  becomes> 123.ary.n
  123.ary.n 1 yap
  get.lab
  to.123
  file.ext make.abc                                                    61
  \ sd
;
```

LLet-Psi.asy

A01770-20161209-A024 ❖ December 9, 2016 ❖ [Page count: 2]

```
: LLet-Psi.asy ; \ For plotting Psi Curves \ %----- Asyst Prog
\ : PsiC-Wks.asy ;
\ %-------------------------------------------------------------------
\     Output Real and Imag Parts of psi to wks file
\ %-------------------------------------------------------------------

\ \ remove path
123.file.name.1
dir.lee.asc "len  1 +   "drop
"dup "len "drop  dir.lee.asc "len "drop -  "sub  123.file.now ":=

\ \ %=================================================================
\ %---------------------------------------    Morlet (new)
123.file.now  v.t zreal  " Re-N"  1 a2wks
123.file.now  v.t zimag  " Im-N"  2 a2wks
123.file.now  v.t zimag []size swap drop real ramp
" $$[(3,1024)]"  3 a2wks

\ \ %=================================================================
\ %---------------------------------------    ridge
\ " RIWV.wka"  v.t zreal  " Re-R"  1 a2wks
\ " RIWV.wka"  v.t zimag  " Im-R"  2 a2wks
\ " RIWV.wka"  v.t zimag []size swap drop real ramp
\ " $$[(3,1024)]"  3 a2wks
\ \ \ %=============================================================
\ \ %---------------------------------------    Morlet (new)
\ " RImorlet.wka"  v.t zreal  " Re-N"  1 a2wks
\ " RImorlet.wka"  v.t zimag  " Im-N"  2 a2wks
\ " RImorlet.wka"  v.t zimag []size swap drop real ramp
\ " $$[(3,1024)]"  3 a2wks
\ %=================================================================

\ \ %=================================================================
\ %---------------------------------------    template for a2wks
: model
" morletRI.wka"  v.t zreal  " Re-ori+d" 15 a2wks
" morletRI.wka"  v.t zimag  " Im-ori+d" 16 a2wks

" morletRI.wka"  v.t zreal  " Re-ori"    1  a2wks
" morletRI.wka"  v.t zimag  " Im-ori"    2  a2wks

" morletRI.wka"  v.t zreal  " Re-old"    3  a2wks
" morletRI.wka"  v.t zimag  " Im-old"    4  a2wks

" morletRI.wka"  v.t zreal  " Re-old-s"  5  a2wks
" morletRI.wka"  v.t zimag  " Im-old-s"  6  a2wks

" morletRI.wka"  v.t zreal  " Re-old+s"  7  a2wks
" morletRI.wka"  v.t zimag  " Im-old+s"  8  a2wks

" morletRI.wka"  v.t zreal  " Re-ori-s"  9  a2wks
" morletRI.wka"  v.t zimag  " Im-ori-s" 10  a2wks
```



```
" morletRI.wka"  v.t zreal  " Re-ori+s" 11  a2wks
" morletRI.wka"  v.t zimag  " Im-ori+s" 12  a2wks

" morletRI.wka"  v.t zreal  " Re-ori-d" 13 a2wks
" morletRI.wka"  v.t zimag  " Im-ori-d" 14 a2wks

" morletRI.wka"  v.t zreal  " Re-ori+d" 15 a2wks
" morletRI.wka"  v.t zimag  " Im-ori+d" 16 a2wks

" morletRI.wka"
v.t zimag []size swap drop
dup
real ramp  s.freq float /
swap 10 +
" $$[(13"
" ,"        "cat
0 n>s       "cat
" )]-ori"  "cat
\ %-%-------------------------------------------
                                      13  a2wks
;

\ \

.....
```

LLet-WPM.asy

A01771-20161209-A025 ❖ December 9, 2016 ❖ [Page count: 3]

```
: LLet-WPM.asy ; \ %----- Asyst Prog
\ \  0: Load Llet-0.txt
\ \  1: Set.cwt
\ \  2: Set.act
\ \  3: action
\ \  4: get.map

token wp.a      exp.mem> wp.a      token wp.p      exp.mem> wp.p
token wp.s      exp.mem> wp.s      token wp.o      exp.mem> wp.o
token x.corn1   exp.mem> x.corn1   token x.corn2   exp.mem> x.corn2
token y.corn1   exp.mem> y.corn1   token y.corn2   exp.mem> y.corn2
8  string no.ext
64 string fidir
" c:\per\mat\0-map\data\"  fidir  ":=

integer scalar best.flag
: get.no.ext
  now.file
  " ."   now.file "within 1  -  ?drop  1 swap "sub
\ " -"                                  "cat
  now.file
  " ."   now.file "within  1  +  ?drop  1      "sub   "cat
  no.ext  ":=
;
: get.map
  cr ." BEST BASIS (1) or BEST LEVEL (2) [at "  best.level 0 n>s s.type
  ."  ] : "
  1
  get.val   best.flag   :=
  best.flag 2 =
  if
\    norm.v.s  becomes> norm.v
\    \ awp.t xsect[ best.level , ! ] becomes> norm.v
\    best.level  norm.l  :=
    norm.v.s  becomes> t1
    norm.l    becomes> t2
    best.level     t2  :=
  else
    norm.v    becomes> t1
    norm.l    becomes> t2
  then

  get.no.ext
  -20   6  sci.format
  cr ." Mat file name for No.Ext:"   no.ext  get.str  no.ext ":=
  fidir   no.ext  "cat   " .sip"  "cat
  "dup  defer>  delete
        defer>  out>file
  0 i.ele :=
  Begin
    i.ele 1 +  i.ele :=
    sig.t    [ i.ele ]  .                              cr
```



```
    i.ele  2 n.power ** =
  Until
  out>file.close

  2 n.power **  real ramp  becomes> wp.a
  wp.a becomes> wp.p
  wp.a becomes> wp.s
  wp.a becomes> wp.o
  wp.a becomes> t8
  wp.a becomes> x.corn1
  wp.a becomes> x.corn2
  wp.a becomes> y.corn1
  wp.a becomes> y.corn2
  0 i.ele :=
  Begin
    i.ele 1 +  i.ele :=
    cr ." i.ele:" i.ele  .
\ -1 mwp :=  \ mwp=0 & wp.o=0 --> no oscillation --> scaling function
             \ mwp=1          --> WB
             \ mwp>1          --> WP

        i.ele  1 -  float
               2    float  t2  [ i.ele ] ** /  floor  mwp            :=
        t1 [ i.ele ]                          wp.a [ i.ele ] := \
           amplitude
        i.ele  mwp 2    t2 [ i.ele ] ** *  -   wp.p [ i.ele ] := \
           position
        n.power         t2 [ i.ele ]   -      wp.s [ i.ele ] := \
           timesupport
        mwp                                   wp.o [ i.ele ] := \
           oscillation
    ."    mwp:"  mwp   .
    i.ele  2 n.power ** =
  Until

  n.power   t8 :=    \ n.power array
  \ wp.p      2 wp.s ** *          becomes>   x.corn1
  \ wp.p 1 +  2 wp.s ** *          becomes>   x.corn2
  wp.p 1 -  2 wp.s ** *          becomes>   x.corn1
  wp.p      2 wp.s ** *          becomes>   x.corn2
  wp.o      2  t8  wp.s - ** *   becomes>   y.corn1
  wp.o 1 +  2  t8  wp.s - ** *   becomes>   y.corn2

  -20   6  sci.format
  fidir   no.ext  "cat   " .mip"  "cat
  "dup  defer>  delete
        defer>  out>file
  0 i.ele :=
  Begin
    i.ele 1 +  i.ele :=
\   x.corn1  [ i.ele ]  .          y.corn1 [ i.ele ] .  cr
    x.corn1  [ i.ele ]  s.freq float /   .
    y.corn1  [ i.ele ]  s.freq float *  2.  /  2 n.power ** float /  .
       cr
    i.ele  2 n.power ** =
```

```
  Until
  out>file.close
  fidir    no.ext  "cat   " .map"   "cat
  "dup  defer>  delete                                                    106
        defer>  out>file
  0 i.ele :=
  Begin
    i.ele 1 +  i.ele :=
\   x.corn2  [ i.ele ]  .           y.corn2 [ i.ele ] .  cr               111
    x.corn2  [ i.ele ]  s.freq float /   .
    y.corn2  [ i.ele ]  s.freq float *  2.  /  2 n.power ** float /  .
       cr
    i.ele  2 n.power ** =
  Until
  out>file.close                                                          116
  fidir    no.ext  "cat   " .amp"   "cat
  "dup  defer>  delete
        defer>  out>file
  0 i.ele :=
  Begin                                                                   121
    i.ele 1 +  i.ele :=
    wp.a     [ i.ele ]  .                                  cr
    i.ele  2 n.power ** =
  Until
  out>file.close                                                          126
  fidir    no.ext  "cat   " .spp"   "cat
  "dup  defer>  delete
        defer>  out>file
  n.power .    jwp.level .   best.flag .   best.level .   s.freq .
  t2  [ 1 ] .  norm.keep.p.best .                                         131
  out>file.close
  cr
  fidir    no.ext  "cat   " .stp"   "cat
  "dup  defer>  delete
        defer>  out>file                                                  136
  wlet s.type  cr  now.file "type   cr best.level 0 n>s s.type
  out>file.close
  \   " c:\per\mat\currentp.stp"
  fidir " cur-map.fip"  "cat
  "dup  defer>  delete                                                    141
        defer>  out>file
  no.ext "type
  out>file.close
  cdtNow
  10 5 fix.format                                                         146
;
\ get.map
```

.....

LLet-WVT.asy

A01772-20161209-A026 ❖ December 9, 2016 ❖ [Page count: 21]

```
: LLet-Rdg.asy ; \ %----- Asyst Prog
\ : LLet-CW2.asy ;

\ Real.FFT

integer scalar #.fre                    scalar mat.inc
integer scalar mat.beg   scalar mat.pts  scalar mat.power
        scalar erf.flag
real scalar f.cen    scalar f.dia    scalar f.shi
real scalar sai.beg  scalar sai.end  scalar sai.now  scalar a.sca
real scalar fre.beg  scalar fre.end  scalar fre.now  scalar fre.inc

1  string rea.or.com
1  string psi.flag
1  string pha.switch.flag
12 string now.file.2
token t3  exp.mem> t3
token t4  exp.mem> t4
32 string wlet
64 string fidir
" c:\per\mat\0-cwt\data\"  fidir  ":=

: get.sai \ sai.beg ~ large value ~ large scale ~ low frequency
          \ sai.end ~ small value ~ small scale ~ high frequency
  1 erf.flag =
  if
    \ Erfc[ .4 (f+2.5) - 2 ] * 3 + 5
    2.  2. *       7.5 -2.5  -  /
    fre.now  -2.5  -  *
    2   -
    erf
    1  swap -
    sai.beg  sai.end -
    2. /
    *
    sai.end  +
  then
  2 erf.flag =
  if
    s.freq  float 2. /  2. /  f.cen  :=   \ % Nyquist first then divided
        by 2
    s.freq  4.        /       f.dia  :=   \ % Spread width of Erfc[x] is
        about 4;
    0.                        f.shi  :=   \ %    while Erfc[+2]=0 and
       Erfc[-2]=>2.
    \  % Erfc[ (f - f.cen )/f.dia - f.shi ] /2 * (sai.beg - sai.end)
    fre.now  f.cen -    f.dia  /
    f.shi -
    erf
    1  swap  -
    2. /
    sai.beg  sai.end -    *
```



```
    sai.end  +
  then
  \  0 erf.flag =
  1  erf.flag  <>
  2  erf.flag  <>  and
  if
    #.fre  1 >
    if
      sai.end  sai.beg -
      fre.end  fre.beg - /
      fre.now  fre.beg - *
      sai.beg  +
    else
      sai.beg
    then
  then
  sai.now  :=
;
\ %================================================================
\ %1 If not shifted, Re-part of psi is symmetrical and Im-part anti-
   symmetrical.
\ %2 Whether shifted or not, both Re- and Im-part are sinusoidal.
\ %3 Analytical Modulus =~= Real part Envelope
\ %4 Ridge extraction from envelope.
\ %5 Poor phase information
\ %================================================================
: get.psi.sca.new \ Original -- The same as Morlet's
  \ rev[ 1 ] is placed in ramp
  \ % ========================================  Carrier
  exp.flag 1 =
  exp.flag 2 = or
  if
    2  n.power **
  else
    2  n.power 1 - **
  then
  real ramp  1. -
  \ %!%---------------------------
    dup 1. +
    rev[ 1 ]
    neg
    catenate
  \    dup  -1 rotate
  \    0.   over [ tmp.v.i    ] :=
  \    rev[ 1 ]
  \  neg
  \    catenate
  \ %~%---------------------------
  s.freq  /   \ absolute time
  becomes> t2

  \ % ========================================  Carrier
  T2
  \ %!%---------------------------------------
  \ %  Choose one !
```

```
    sai.now *  a.sca /            \ %%       use to.mat.e.p --> good
      mod, poor pha
\   sai.now *  a.sca / pi 2. / +  \ %%       use to.mat.e.p -->
\   sai.now *  a.sca / pi 2. / -  \ %% The wavelet is positively        106
    shifted
   "  (Phase adjusted: 0)"  tmp.s.9  ":=
\ %!%-----------------------------------------
\ % %----  neg  dup  cos  swap  sin  z=x+iy
dup  cos  swap  sin  z=x+iy       \ The negative sign is removed for
                                  \    consistent definition of FT      111
                                     pairs.
becomes> u.t

\ % ========================================  Modulator
t2
\ %--%                            \ %%  ? Don't shift here (the index   116
\ %                                     has been in good match). ---
    ?
\ %!%-----------------------------------------
\ %  Choose one!
   1. *                           \ %% No shift
\   pi 2. /  a.sca *  sai.now / + \ %% The envelope is negatively       121
    shifted.
\   pi 2. /  a.sca *  sai.now / - \ %% The envelope is positively
    shifted.
\ %^%-----------------------------------------
dup *
2. /  a.sca /  a.sca /  neg
becomes> v.t                                                           126

0 tmp.v.i :=                            \  Treat those values that
    cause
begin                                   \    numerical underflow when
    taken
  tmp.v.i 1 +  tmp.v.i :=               \    to exponential.
  -50.   v.t [ tmp.v.i ]  >=                                           131
  if
    -50.   v.t [ tmp.v.i ]  :=
  then
  exp.flag 1 =
  exp.flag 2 =  or                                                     136
  if
    tmp.v.i   2 n.power 1 +    **   =
  else
    tmp.v.i   2 n.power        **   =
  then                                                                 141
until
v.t  exp    becomes> v.t

u.t  v.t  *  pi  -0.25  **  *
a.sca  sqrt /                                                          146
becomes> v.t

\ % ========================================  render analytic signal
    of psi
```



```
  \ % Theoretically, there is no effect except a factor 2 difference in
      modulus.
  \   \ % v.t   dup    hilbert   0  1 z=x+iy   *  +                     151
  \   v.t   dup    hilbert   0 +1 z=x+iy   *  +   \ \ %  H[cos(x)]= -
      sin(x)
  \   2. /                                          \      render ~0 v.t
  \   becomes> v.t
  \   v.t   dup    hilbert   0 -1 z=x+iy   *  +   \ \ %  H[cos(x)]= +
      sin(x)
  \   2. /                                          \      compatible with  156
      mine
  \   becomes> v.t
  \  \ %^% ----------- Original
  \ % ========================================  difference : A[psi]-psi
  \ % How analytic is the Morlet wavelet?
  \   v.t                                                              161
  \   v.t   dup    hilbert   0 -1 z=x+iy   *  +   \ \ %  H[cos(x)]= + sin
      (x)
  \   2. /
  \   swap -
  \   becomes> v.t
;                                                                      166
\ %
  ============================================================================

\ %  Both Re & Im parts of psi are symmetrical.
\ %  If not shifted, Im part is not sinusoidal ---> Ridge extration from
    phase.
\ %  If shifted, Re part is not sinusoidal ---> Ridge extraction from
    envelope.
\ %                                                                    171
  ============================================================================

\ : get.psi.sca.old  \ Ridge detection from phase plot --- Use
    to.mat.e.p
: get.psi.sca.old \ Ridge detection from phase plot --- Use to.mat.e.p
  \ rev[ 1 ] is placed after ramp
  \ % ========================================  Carrier
  exp.flag 1 =                                                         176
  exp.flag 2 = or
  if
    2  n.power **
  else
    2  n.power 1 - **                                                  181
  then
  \ real ramp  s.freq  /   \ absolute time
  real ramp  1. -  s.freq  /   \ absolute time
  \ %!%-----------------------------------------
  \ %  Choose one!                                                     186
  \                              \ %% Old - Detection of ridge in
      phase plane
  psi.flag "upper " R" "=
  if
  \   sai.now *  a.sca / pi 2. / +  \ %%  -shift  to.mat.e.p --> good
      ridge, bad pha
```

```
    sai.now *  a.sca / pi 2. / -  \ %%  +shift                          191
  "  (Phase adjusted: -pi/2)"  tmp.s.9  ":=
else
    sai.now *  a.sca /            \ %%       use to.mat.e.p --> good
       mod & pha
  "  (Phase adjusted: 0)"  tmp.s.9  ":=
then                                                                    196
\ %^%----------------------------------------
\  dup  cos  swap  neg  sin  z=x+iy
neg  dup  cos  swap  sin  z=x+iy
becomes> u.t
                                                                        201
\ % ========================================  Modulator
exp.flag 1 =
exp.flag 2 = or
if
  2  n.power **                                                        206
else
  2  n.power 1 - **
then
real ramp  1. -  s.freq  /   \ absolute time
\ %!%----------------------------------------                         211
\ %  Choose one!
psi.flag "upper " R" "=
if
\  pi 2. /  a.sca *  sai.now / + \ %% The envelope is negatively
    shifted.
   pi 2. /  a.sca *  sai.now / - \ %% The envelope is positively        216
      shifted.
else
   1. *                          \ %% No shift
then
\ %^%----------------------------------------
dup *                                                                   221
2. /  a.sca /  a.sca /  neg
becomes> v.t
0 tmp.v.i :=
begin
  tmp.v.i 1 +  tmp.v.i :=                                               226
  -50.   v.t [ tmp.v.i ]  >=
  if
    -50.   v.t [ tmp.v.i ]  :=
  then
  exp.flag 1 =                                                          231
  exp.flag 2 =  or
  if
    tmp.v.i   2 n.power     **   =
  else
    tmp.v.i   2 n.power 1 - **   =                                      236
  then
until
v.t  exp    becomes> v.t

  u.t  v.t  *  pi  -0.25  **  *                                         241
  dup  -1 rotate
```



```
    \  %    0.   over [ tmp.v.i    ] :=
    dup [ tmp.v.i 1 - ]    over [ tmp.v.i    ] :=
    rev[ 1 ]
  catenate                                                              246

  a.sca  sqrt /

  becomes> v.t
                                                                        251
  v.t  conj                  \ Match the +- sign of the definition of FT
     pair
  becomes> v.t

  \ \% v.t   dup    hilbert      z=x+iy     \ render analytic signal
  \ v.t   dup    hilbert   0 1 z=x+iy   *  +      \ render analytic      256
     signal of psi
  \ becomes> v.t

  \  \\ v.t []size  2 / rotate   \ peak at center
  \  \\ becomes> v.t
;                                                                       261

: get.psi.sca
  psi.flag "upper " 0" "=
  psi.flag "upper " R" "=  or
  if                                                                    266
    get.psi.sca.old
  else
    get.psi.sca.new
  then
;                                                                       271
: test.hilbert.sign.compatibility
  gd
  up
  v.t  zreal
  2. *                                                                  276
  1 yap
  v.t  zreal   hilbert
  2. *
  5 ydp
  v.t   dup    hilbert   0  +1  z=x+iy   *  +                         281
  zreal
  \ 1 yap
  2 ydp
  dp
  v.t  zimag                                                            286
  2. *
  1 yap
  v.t   dup    hilbert   0  +1  z=x+iy   *  +
  zimag
  2 ydp                                                                 291
  hp
;
: ini.re.im.ary
  1 tmp.v.i :=
```

```
  2 mat.power **    real ramp                                    296
    begin
      tmp.v.i 1 +  tmp.v.i :=
      2 mat.power **  real ramp
      laminate
      tmp.v.i  #.fre  >=                                       301
    until
  becomes> rt.t
  rt.t  trans[ 1 , 2 ]  becomes> rt.t
  0.  rt.t :=
  rt.t becomes> at.t                                           306
  rt.t becomes> wp.a
;

: get.v.t.sub \ show half
  exp.flag 1 =                                                 311
  exp.flag 2 = or
  if
    sub[ 1 , 2 n.power     ** ]
  else
    sub[ 1 , 2 n.power 1 - ** ]                                316
  then
;
: get.mat.sub
  sub[ 1 , mat.pts , mat.inc ]
;                                                              321
: cwt
  #.fre real ramp becomes> a.coef
  a.coef  becomes> b.coef
  a.coef  becomes> p.coef
                                                               326
  fre.beg  fre.inc   #.fre 1 - *  +  fre.end :=
  n.wt1  my.power
  dir.lee.asc  now.file "cat  ftoa.bat
  get.sub.a
  becomes> sig.t            \ data                             331
  ini.re.im.ary
  fre.beg   fre.now :=
  gd hp
  1  vi1  :=
  Begin                                                        336
    get.sai
    sai.now   2 pi fre.now * *  /   a.sca :=
    get.psi.sca             \ get v.t : scaled psi

    3 0 fix.format  cr  vi1 .                                  341
    5 2 fix.format  ."  f="  fre.now n.type
        ."  s=" sai.now .  7 4 fix.format  ."  A=" a.sca n.type
    fre.now   b.coef [ vi1 ] :=
    a.sca     a.coef [ vi1 ] :=
    sai.now   p.coef [ vi1 ] :=                                346
    v.t zreal  get.v.t.sub  up 1 yap
    v.t zimag  get.v.t.sub  dp 1 yap
        now.file  \ " --" "cat now.file.2  "cat
        \ "   [File No. " "cat    file.no 1 +  0 n>s  "cat     "  ]"
```



```
          "cat
        normal.coords .5  .05 position                         351
        "  [" "cat psi.flag "cat " ]" "cat
        tmp.s.9 "cat
        "  f=" "cat  fre.now 0.00001 + -2 n>s  "cat
        "  s=" "cat  sai.now  -2 n>s  "cat
        "  A=" "cat  a.sca    -3 n>s  "cat                     356
        centered.label world.coords
    exp.flag 1 =
    if
      sig.t  sub[ 1 , 2 n.power 1 - ** ] rev[ 1 ]
      sig.t                                                    361
      catenate
      sig.t  sub[ 2 n.power 1 - **  1 + , 2 n.power 1 - ** ] rev[ 1 ]
      catenate
    else  \ exp.flag=0 , 2
      sig.t                                                    366
    then
    \   dup    hilbert      z=x+iy     \ render analytic signal
                    fft          \ F^(w)
    v.t    conj    fft rev[ 1 ]   \ G^(-w)  , psi=conj(g)
    \    v.t          fft rev[ 1 ]       \ G^(-w)              371
    \    *  a.sca  sqrt /                \ move to get.psi.sca
    *                              \ for move to get.psi.sca
    ifft
    dup zreal envelope
    exp.flag 1 =                                               376
    exp.flag 2 = or
    if
      sub[ 2 n.power 1 - **  1 + , 2 n.power ** ]
    else
    then                                                       381
    get.mat.sub
    wp.a  xsect[ ! , vi1 ] :=
    exp.flag 1 =
    exp.flag 2 = or
    if                                                         386
      sub[ 2 n.power 1 - **  1 + , 2 n.power ** ]
    else
    then
    get.mat.sub
    dup  zreal  rt.t  xsect[ ! , vi1 ] :=                      391
    zimag  at.t  xsect[ ! , vi1 ] :=
    fre.now  fre.inc +   fre.now :=
    vi1 1 +  vi1 :=
    \  vi1    #.fre 1 +   >
    vi1    #.fre 1 +   =                                       396
  Until
  exp.flag 2 =
  if
    sig.t  sub[ 2 n.power 1 - **  1 + , 2 n.power ** ]  becomes> sig.t
  then                                                         401
;

: to.mat.p
```

```
  becomes> awp.t
  \ awp.t    []size tmp.v.i := drop                                    406
  -12  6 sci.format
  0 vi2 :=
  begin
    vi2 1 +  vi2 :=
    0 vi1 :=                                                          411
    begin
      vi1 1 +  vi1 :=
      awp.t [ vi2 , vi1 ]  .
      vi1  #.fre  =
    until                                                             416
    cr
    vi2 2 mat.power ** =
  until
;
: compu.pha.res \ -pi <--> pi    + pi                                 421

  0 tmp.v.i :=  \ reassign rt.t when rt.t=0 in denominator
  begin
    tmp.v.i 1 +  tmp.v.i :=
    rt.t xsect[ ! , tmp.v.i ]                                         426
    dup abs  []max  tmp.v :=                \ X
    becomes> t1
    0 vi1 :=
    begin
      vi1 1 +  vi1 :=                                                 431
      t1 [ vi1 ]  0.  =
      if
        tmp.v  10. -10. ** *
        rt.t xsect[ ! , tmp.v.i ]  [ vi1 ]   :=
      else                                                            436
      then
      vi1  2 mat.power ** =
    until
    tmp.v.i  #.fre =
  until                                                               441

  0 tmp.v.i :=
  begin
    tmp.v.i 1 +  tmp.v.i :=
    \    at.t xsect[ ! , tmp.v.i ]                    \ Y             446
    \    rt.t xsect[ ! , tmp.v.i ]   /                \ X
    \    atan
    \    becomes> t1

    rt.t xsect[ ! , tmp.v.i ]                    \ X                  451
    at.t xsect[ ! , tmp.v.i ]                    \ Y
    z=x+iy
    zarg  pi + becomes> t1

    t1  bwp.t xsect[ ! , tmp.v.i ]  :=                                456
    tmp.v.i  #.fre =
  until
;
```



```
: compu.pha \ 0 -- 2pi                                                461

  \  pha.switch.flag  "upper " Y"  "=
  pha.switch.flag  "upper " R"  "=
  if    \ % switch real and imaginary parts
    rt.t   becomes>  t4                                               466
    at.t   becomes>  t3
  else
    rt.t   becomes>  t3
    at.t   becomes>  t4
  then                                                                471

  0 tmp.v.i :=  \ reassign rt.t when rt.t=0 in denominator
  begin
    tmp.v.i 1 +  tmp.v.i :=
    t3   xsect[ ! , tmp.v.i ]                                         476
    \ rt.t xsect[ ! , tmp.v.i ]
    dup abs  []max  tmp.v :=                \ X
    becomes> t1
    0 vi1 :=
    begin                                                             481
      vi1 1 +  vi1 :=
      t1 [ vi1 ]  0.  =
      if
        tmp.v  10. -10. ** *
        t3   xsect[ ! , tmp.v.i ]  [ vi1 ]   :=                       486
        \ rt.t xsect[ ! , tmp.v.i ]  [ vi1 ]   :=
      else
      then
      vi1  2 mat.power ** =
    until                                                             491
    tmp.v.i  #.fre =
  until

  0 tmp.v.i :=
  begin                                                               496
    tmp.v.i 1 +  tmp.v.i :=
    t4 xsect[ ! , tmp.v.i ]                    \ Y
    t3 xsect[ ! , tmp.v.i ]   /                \ X
    \ rt.t xsect[ ! , tmp.v.i ]   /                \ X
    atan                                                              501
    becomes> t1

    0 vi1 :=
    begin
      vi1 1 +  vi1 :=                                                 506
      t1 [ vi1 ]  0  >=
      if
        t4 xsect[ ! , tmp.v.i ]  [ vi1 ] 0 >=
        \ at.t xsect[ ! , tmp.v.i ]  [ vi1 ] 0 >=
        if                                                            511
        else
          t1 [ vi1 ]       pi      +  t1 [ vi1 ] :=
        then
```

```
      else
        t4 xsect[ ! , tmp.v.i ]  [ vi1 ] 0 >                          516
        \ at.t xsect[ ! , tmp.v.i ]  [ vi1 ] 0 >
        if
          t1 [ vi1 ]       pi      +  t1 [ vi1 ] :=
        else
          t1 [ vi1 ]       pi 2 * +  t1 [ vi1 ] :=                    521
        then
      then
      vi1  2 mat.power ** =
    until
                                                                       526
    t1  bwp.t xsect[ ! , tmp.v.i ]  :=
    tmp.v.i  #.fre =
  until
;
                                                                       531
: to.mat.p.2
  0 tmp.v.i :=
  begin
    1  tmp.v.i +  tmp.v.i :=
    dup  [ tmp.v.i ] .                                                 536
    tmp.v.i  #.fre =
  until
  drop
;
                                                                       541
: to.mat.m.p \ modulus  and phase
  psi.flag  " N"  "=
  if
    " Adapted CWT"  wlet ":=
  " M1" s.type                                                         546
  then
  psi.flag  " 0"  "=
  if
    " Wavelet Variant (M)"  wlet ":=
  " M2" s.type                                                         551
  then

  \ " Adapted CWT"  wlet ":=
  get.no.ext
  -20   6  sci.format                                                  556
  cr ." Mat file name for No.Ext:"   no.ext  get.str  no.ext ":=
    fidir   no.ext  "cat  " .sic"  "cat
  cr ." WLET:"   wlet  get.str  wlet ":=
    "dup  defer>  delete
          defer>  out>file                                             561
    0 i.ele :=
    Begin
      i.ele 1 +  i.ele :=
      sig.t    [ i.ele ]  .                                  cr
      \ i.ele  2 mat.power ** =                                        566
      i.ele  2 n.power ** =    \ not mat.power
    Until
    out>file.close
```



```
      rt.t  dup *                                                      571
      at.t  dup * +
      sqrt
      becomes> awp.t

  \  \   Envelope of modulus                                          576
  \  0 tmp.v.i :=
  \  begin
  \    1  tmp.v.i +  tmp.v.i :=
  \    awp.t xsect[ ! , tmp.v.i ]   envelope
  \    awp.t xsect[ ! , tmp.v.i ]   :=                                581
  \    tmp.v.i  #.fre =
  \  until

    fidir no.ext "cat  " .amc" "cat
    "dup  defer> delete                                              586
          defer> out>file
    awp.t   to.mat.p
    out>file.close

  awp.t  becomes> bwp.t                                              591
  compu.pha
    fidir no.ext "cat  " .phc" "cat
    "dup  defer> delete
          defer> out>file
    bwp.t   to.mat.p                                                 596
    out>file.close
  cr fidir   no.ext  "cat  " .scc"  "cat
    "dup  defer>  delete
          defer>  out>file
    b.coef  to.mat.p.2  cr                                           601
    a.coef  to.mat.p.2  cr
    p.coef  to.mat.p.2
    out>file.close
  cr fidir   no.ext  "cat  " .spc"  "cat
    "dup  defer>  delete                                             606
          defer>  out>file
    n.power .    jwp.level .   best.flag .   best.level .   s.freq .
    mat.power .  mat.inc   .
    \ t2  [ 1 ] .
                                                                     611
    out>file.close
  cr fidir   no.ext  "cat  " .stc"  "cat
    "dup  defer>  delete
          defer>  out>file
    wlet s.type  cr  now.file "type   cr best.level 0 n>s s.type     616
    cr    pha.switch.flag   s.type
    out>file.close
  cr fidir  " cur-cwt.fip"  "cat
    "dup  defer>  delete
          defer>  out>file                                           621
    no.ext "type
    out>file.close
  cdtNow
```

```
  10 5 fix.format
;                                                                    626
: to.mat.e.p \ envelope  and phase
  psi.flag  " N"  "=
  if
    " Adapted CWT"  wlet ":=
  " E1" s.type                                                       631
  then
  psi.flag  " O"  "=
  if
    " Wavelet Variant (H)"  wlet ":=
  " E2" s.type                                                       636
  then

  \ " Adapted CWT"  wlet ":=
  get.no.ext
  -20   6  sci.format                                                641
  cr ." Mat file name for No.Ext:"   no.ext  get.str  no.ext ":=
    fidir   no.ext  "cat  " .sic"  "cat
  cr ." WLET:"   wlet  get.str  wlet ":=
    "dup  defer>  delete
          defer>  out>file                                           646
    0 i.ele :=
    Begin
      i.ele 1 +  i.ele :=
      sig.t    [ i.ele ]  .                                  cr
      i.ele  2 n.power ** =   \ not mat.power                        651
    Until
    out>file.close

    \     rt.t  dup *
    \     at.t  dup * +                                              656
    \     sqrt
    \     becomes> awp.t

    wp.a           \ envelope
    becomes> awp.t                                                   661

    fidir no.ext "cat  " .amc" "cat
    "dup  defer> delete
          defer> out>file
    awp.t   to.mat.p                                                 666
    out>file.close

  awp.t  becomes> bwp.t
  compu.pha
    fidir no.ext "cat  " .phc" "cat                                  671
    "dup  defer> delete
          defer> out>file
    bwp.t   to.mat.p
    out>file.close
  cr fidir   no.ext  "cat  " .scc"  "cat                             676
    "dup  defer>  delete
          defer>  out>file
    b.coef  to.mat.p.2  cr
```



```
    a.coef  to.mat.p.2  cr
    p.coef  to.mat.p.2                                               681
    out>file.close
  cr fidir   no.ext  "cat  " .spc"  "cat
    "dup  defer>  delete
          defer>  out>file
    n.power .    jwp.level .   best.flag .   best.level .   s.freq .  686
    mat.power .  mat.inc   .
    \ t2  [ 1 ] .

    out>file.close
  cr fidir   no.ext  "cat  " .stc"  "cat                            691
    "dup  defer>  delete
          defer>  out>file
    wlet s.type  cr  now.file "type   cr best.level 0 n>s s.type
    cr    pha.switch.flag   s.type
    out>file.close                                                   696
  cr fidir  " cur-cwt.fip"  "cat
    "dup  defer>  delete
          defer>  out>file
    no.ext "type
    out>file.close                                                   701
  cdtNow
  10 5 fix.format
;
: to.mat
  psi.flag "upper  " O" "=                                           706
  psi.flag "upper  " R" "=  or
  cr
  if
    " to.mat.E.p" s.type.3  cr
    " Phase switch flag : "  s.type  pha.switch.flag s.type.3        711
    to.mat.e.p
  else
    " to.mat.M.p" s.type.3
    " Phase switch flag : "  s.type  pha.switch.flag s.type.3
    to.mat.m.p                                                       716
  then
  cr
;
: cwt.56
\ ------------------------------------------------------------       721
  5  4  goto.xy
     ." Now.file (name.ext):"  now.file  s.type \ get.str  now.file ":=
  5  5  goto.xy 4 0 fix.format
  n.wt1  my.power
     ." Number of points of wavelet (n.wt1):"                        726
     2 n.power **  n.type \ get.val  n.wt1 :=
  5  6  goto.xy
     ." Sampling freq -- original rate (s.freq.keep):"
     s.freq.keep  n.type \ get.val  s.freq.keep :=
  5  7  goto.xy 2 0 fix.format                                       731
     ." Index Interval for Sub-sampling:" i.inc  n.type \ get.val  i.inc
         :=
     s.freq.keep  float  i.inc float /   6  2  fix.format
```

```
    ."    (Sub-Sampling rate: "   1 n>s s.type  ." )"
  5  8  goto.xy 4 0 fix.format
    ." Index of first point of array" i.beg  n.type \ get.val  i.beg :=  736
  5  9  goto.xy
    ." PSI flag (New or Old [ or old's Ridge in envelope]): "
    psi.flag s.type \ get.str psi.flag ":=
\ ------------------------------------------------------------
  n.wt1  my.power                                                      741
  5  10 goto.xy 7 3 fix.format
    ." Fre.beg:"
    fre.beg  n.type \ get.val  fre.beg  :=
  5  11 goto.xy 3 0 fix.format
    ." Number of freq resolution (#.fre):"  #.fre  n.type \ get.val #    746
      .fre :=
  5  12 goto.xy 7 3 fix.format
    ." Fre.inc:"  fre.inc  n.type \ get.val  fre.inc  :=
          fre.beg #.fre 1 - fre.inc * + ." (Freq. range:"
          fre.beg n.type ." --" n.type ." )"
  5  13 goto.xy                                                        751
    ." ERF flag [1:fixed relation,  2:varing (Nyquist), Else:linear)] :
      "
                erf.flag n.type \ get.val  erf.flag :=
  5  14 goto.xy 6 3 fix.format
    ." sai.beg [ Low frequency ] :"  sai.beg  n.type \ get.val  sai.beg
       :=
  5  15 goto.xy                                                        756
    ." sai.end [ High frequency ] :"  sai.end  n.type \ get.val
      sai.end  :=
  5  16 goto.xy 4 0 fix.format
    ." Expand Flag(0, 1, 2):"  exp.flag  n.type \ get.val  exp.flag :=
  5  17 goto.xy
    ." MAT.pts (number of points to be used in MMA plot):"             761
    Mat.pts n.type \ get.val mat.pts  :=
    2 n.power ** mat.pts / mat.inc :=
    n.power \ for recover
    mat.pts my.power n.power mat.power :=
    n.power :=  \ recover                                              766
  5  18 goto.xy  1 0 fix.format
    ." MAT.beg (From 1 to " mat.inc . ." ):" 1  n.type \ get.val
      mat.beg  :=
     10 5 fix.format
\ ============================================================
;                                                                    771
: set.cwt
\   n.wt1  my.power
\
\   5  10     goto.xy    6 2 fix.format
\      ." Fre.beg:"    7 3 fix.format                                 776
\      \ ." Fre.beg (original rate at " s.freq.keep n.type ." ):"    7 3
    fix.format
\      fre.beg  get.val  fre.beg  :=
\      3 0 fix.format
\   5  11     goto.xy
\      ." Number of freq resolution (#.fre):"  #.fre  get.val #.fre :=   781
\   5  12     goto.xy                                    7 3 fix.format
```



```
\      ." Fre.inc:"  fre.inc  get.val  fre.inc  :=
\            fre.beg #.fre 1 - fre.inc * + ." (Freq. range:"
\            fre.beg n.type ." --" n.type ." )"
\   5  13     goto.xy                                                 786
\      ." ERF flag [1:fixed relation,  2:varing (Nyquist), Else:linear)]
    :"
\                  erf.flag get.val  erf.flag :=       6 3 fix.format
\   5  14     goto.xy
\      ." sai.beg [ Low frequency ] :"  sai.beg  get.val  sai.beg  :=
\   5  15     goto.xy                                                 791
\      ." sai.end [ High frequency ] :"  sai.end  get.val  sai.end  :=
\   4 0 fix.format
\
\   5  16     goto.xy
\      ." Expand Flag(0, 1, 2):"  exp.flag  get.val  exp.flag :=      796
\   5  17     goto.xy
\   \  ." MAT.pts:"  256                  get.val  mat.pts  :=
\      ." MAT.pts (number of points to be used in MMA plot):"
\      Mat.pts              get.val  mat.pts  :=
\   2 n.power **  mat.pts /          mat.inc :=                       801
\   n.power     \ for recover
\   mat.pts  my.power n.power  mat.power :=
\   n.power :=  \ recover
\   1 0 fix.format
\   5  18     goto.xy                                                 806
\      ." MAT.beg (From 1 to " mat.inc . ." ):" 1  get.val  mat.beg  :=
\   10 5 fix.format
;

\ : ini.par                                                          811

: plot.cwt.mag
  0 tmp.v.i :=
  begin
    tmp.v.i 1 +  tmp.v.i :=                                          816
    rt.t xsect[ ! , tmp.v.i ] dup *
    at.t xsect[ ! , tmp.v.i ] dup * +
    sqrt

    tmp.v.i  1 =                                                     821
    if
      tmp.v.i yap
    else
      yadp.flag " a" "=
        if  tmp.v.i yap                                              826
        else
            tmp.v.i ydp
        then
    then
    my.pause                                                         831
    tmp.v.i  #.fre =
  until
;
: plot.cwt.root \ [ 2D-array - ]
  0 tmp.v.i :=                                                       836
```

```
  begin
    tmp.v.i 1 +  tmp.v.i :=
    dup
    xsect[ ! , tmp.v.i ]
    tmp.v.i  1 =                                                    841
    if
      tmp.v.i yap
    else
      yadp.flag " a" "=
        if  tmp.v.i yap                                             846
        else
            tmp.v.i ydp
        then
    then
    my.pause                                                        851
    tmp.v.i  #.fre =
  until
  drop
;
                                                                    856
: plot.cwt.arg
  bwp.t
  plot.cwt.root
;
: plot.cwt.rea                                                      861
  rt.t
  plot.cwt.root
;
: plot.cwt.img
  at.t                                                              866
  plot.cwt.root
;
: plot.cwt.env
  wp.a
  plot.cwt.root                                                     871
;
: plot.cwt.arg.res
  0 tmp.v.i :=
  begin
    tmp.v.i 1 +  tmp.v.i :=                                         876
    at.t xsect[ ! , tmp.v.i ]                       \ Y
    rt.t xsect[ ! , tmp.v.i ]   /                   \ X
    atan
    becomes> t1
                                                                    881
    0 vi1 :=
    begin
      vi1 1 +  vi1 :=
      t1 [ vi1 ]  0  >=
      if                                                            886
        at.t xsect[ ! , tmp.v.i ]   [ vi1 ] 0 >=
        if
        else
          t1 [ vi1 ]      pi      +  t1 [ vi1 ] :=
        then                                                        891
```



```
      else
        at.t xsect[ ! , tmp.v.i ]   [ vi1 ] 0 >
        if
          t1 [ vi1 ]      pi      +  t1 [ vi1 ] :=
        else                                                        896
          t1 [ vi1 ]      pi 2. * +  t1 [ vi1 ] :=
        then
      then
      vi1  2 mat.power ** =
    until                                                           901

    t1
    tmp.v.i  1 =
    if
      tmp.v.i yap                                                   906
    else
      yadp.flag " a" "=
        if  tmp.v.i yap
        else
            tmp.v.i ydp                                             911
        then
    then
    my.pause
    tmp.v.i  #.fre =
  until                                                             916
;
: run.coh
  cr  " You must input LCoh-related file (eg. LCoh-0.asy)!"  s.type
;
: for.case5&6                                                       921
\           5   4  goto.xy
\              ." Now.file (name.ext):"  now.file  get.str  now.file ":=
\           5   5  goto.xy
\           4 0 fix.format
\           n.wt1  my.power                                         926
\              ." Number of points of wavelet (n.wt1):"
\             2 n.power **  get.val  n.wt1 :=
\           5   6  goto.xy
\              ." Sampling freq -- original rate (s.freq.keep):"
\             s.freq.keep  get.val  s.freq.keep :=                  931
\           5   7  goto.xy
\           2 0 fix.format
\              ." Index Interval for Sub-sampling:" i.inc  get.val
  i.inc :=
\              s.freq.keep  float  i.inc float /   6  2  fix.format
\                           ."    (Sub-Sampling rate: "   n.type  ." )"  936
\             ."    (Sub-Sampling rate: "   1 n>s s.type  ." )"
\           5   8  goto.xy
\           4 0 fix.format
\              ." Index of first point of array" i.beg  get.val  i.beg
  :=
\           5   9  goto.xy                                          941
\              ." PSI flag (New or Old [ or old's Ridge in envelope]): "
\             psi.flag  get.str  psi.flag ":=
            psi.flag "upper " R"  "=
```

```
            if
              \  " Y"     pha.switch.flag  ":=                              946
              psi.flag    pha.switch.flag  ":=
              cr  ."                                  ->PhaseSwitch (R:yes;
                 X:No):"
              pha.switch.flag  get.str   pha.switch.flag  ":=
            else
              \  " N"     pha.switch.flag  ":=                              951
              psi.flag    pha.switch.flag  ":=
            then
;
\ : set.act
\   gd                                                                      956
\   gd.txt.wnd  sc   {border}
\   3   2   goto.xy
\      ." 1:Dec&Rec, 2:M0.phase, 3:Norm.wt, 4:Entropy, 5:CWT, 6:Coh --"
\   act.flag  get.val  act.flag :=
\   act.flag                                                                961
\   case
\     3  of  for.norm&ent  endof
\     4  of  for.norm&ent
\            \        5   14 goto.xy
\          cr ." #.div:"  #.div  get.val  #.div :=                          966
\                         endof
\ \     5  of  for.case5&6
\ \            cr set.cwt
\ \            cwt           endof
\ \     6  of  for.case5&6                                                  971
\ \            cr set.cwt
\ \            cr set.123
\ \            \ 5  19     goto.xy
\ \            cr
\ \            ." Real or Imag or Comp:" rea.or.com get.str "upper        976
   rea.or.com ":=
\ \            10 5 fix.format
\ \                        endof
\ \            run.coh
\     5  of  cwt.56
\            for.case5&6                                                  981
\            cr set.cwt
\            cr new.pause
\            cwt           endof
\     6  of  cwt.56
\            for.case5&6                                                  986
\            cr set.cwt
\            5  19 goto.xy
\            \ cr
\            ." Real or Imag or Comp:" rea.or.com s.type \ get.str
   "upper rea.or.com ":=
\            cr new.pause                                                 991
\            cr set.123
\            10 5 fix.format
\            run.coh
\                       endof
\   endcase                                                              996
```



```
\ ;
: set.act
  gd
  gd.txt.wnd  sc   {border}
  3   2   goto.xy                                                        1001
  ." D:Dec&Rec, P:Phase.M0s, N:Norm.wt, E:Entropy, C:CWT, W:WCoh :: "
  act.flag.str s.type \ get.str  act.flag.str ":=
  act.flag.str "upper " N" "=
  if
    for.norm&ent                                                         1006
  then
  act.flag.str "upper " E" "=
  if
    for.norm&ent
    5  14 goto.xy                                                       1011
    ." #.div:"  #.div n.type \ get.val  #.div :=
  then
  act.flag.str "upper " C" "=
  if
    cwt.56                                                               1016
    for.case5&6
    cr set.cwt
    cr new.pause
    cwt
  then                                                                   1021
  act.flag.str "upper " W" "=
  if
    cwt.56
    for.case5&6
    cr set.cwt                                                           1026
    5  19 goto.xy
    \ cr
    ." Real or Imag or Comp:" rea.or.com s.type \ get.str "upper
       rea.or.com ":=
    cr new.pause
    cr set.123                                                           1031
    10 5 fix.format
    run.coh
  then
;
: ini.par                                                                1036
  1024 n.wt1   :=
  200  s.freq.keep :=
  \ 5    act.flag :=
  " C" act.flag.str ":=
  5    i.inc   :=                                                        1041
  1.6  fre.beg :=
  40   #.fre   :=
  0.1  fre.inc :=
  1    erf.flag :=
  11.0 sai.beg :=                                                        1046
  5.00 sai.end :=
  256  mat.pts :=
  " N" psi.flag ":=
  " b0w6020.4" now.file ":=
```

```
  10 5 fix.format                                                    1051
;
ini.par

.....................................................................................................
```



Lee-Word.asy

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```
: Lee-Word.asy ; \ %----- Asyst Prog                                          1
\ ------------------------------------------------------------------------
\ WORD-w.Lee - 4/30/90,  03/24/91, 10/20/93, 02/20/94
\
\ 1 --> Set my def file dir
\ 2 --> For printer: 1. Set color scheme, 2. Select printer                 6
\ 3 --> Make com file
\
\ Written by Ron Lee
\ ------------------------------------------------------------------------
normal.display                                                              11
  26   0  29  79  window  {c.text}    \ for clearing text
  26  19  29  79  window  {b.text}
  26   0  29  39  window  {l.text}
  26  41  29  79  window  {r.text}
  0    0  29  18  window  {f.text}                                          16
  29   0  29  79  window  {29.line.p1}  \ for BD, etc. operations
  0    0  12  79  window  {tmp.wnd}
  13   0  23  79  window  {show.wnd.l}
  15   9  22  69  window  {show.wnd.s}
\ 16   9  23  69  window  {show.wnd.s}                                      21

integer scalar 29.flag     scalar prn.flag
        scalar lc.flag
        scalar n.wt1 \ for Wavelet transform
                                                                            26
: {29.line}
  29.flag  1  =
  if
    {29.line.p1}
  then                                                                      31
;
: tedious
  cr  ." prn.flag (1:epson-b ; 2:epson-c ; 3:hp-laser) = "
  #input  prn.flag :=
; tedious                                                                   36
1 string  my.pause.flag

integer scalar bg.color
        scalar bell.flag
        scalar pr.bg.color                                                  41
        scalar fg.color
        scalar gr.color
        scalar em.color
        scalar wa.color
        scalar t1.color                                                     46
        scalar t2.color
        scalar outline.color
        scalar my.axis.color
        scalar def.val.flag
        scalar s.freq                                                       51
        scalar prn.no
```



```
        scalar color.sft
        scalar tmp.c            \ current color for foreground and
           curvereal
        scalar prn.scale
        scalar 2.wnd.flag                                                   56
        scalar lc1   scalar lc2   scalar lc3   scalar lc4
        scalar lc5   scalar lc6   scalar lc7   scalar line.c
        scalar fft.sec   scalar n.power
        scalar menu.flag  scalar grid.flag
1 string pcx.h.c.str                                                        61
: my.power
  trunc
  0  n.power  :=
  begin
    float  2.  /   trunc                                                    66
    dup
    dup  1  >=  if   n.power   1 +   n.power :=  then
    1  =
  until
  drop                                                                      71
;

0 menu.flag :=   \ default
1 string wnd.str
1 string y.lab.str                                                          76
1 string offset.str

screen.clear
cr  ." prn.flag"  prn.flag  .   pause
                                                                            81
64 string file.ext
: hp.laser
  0             color.sft           :=
  1000          prn.scale           :=
  145           prn.no              :=                                    86
  140           prn.no              :=  \ HP
  0             pr.bg.color         :=  \          background color
  11 lc1 :=   15 lc2 :=   10 lc3 :=
  13 lc4 :=   12 lc5 :=   14 lc6 :=   15 lc7 :=
  pr.bg.color   vuport.color                                                91
  7             my.axis.color       :=
  my.axis.color axis.color
  12            t1.color            :=
  14            t2.color            :=
  0  bg.color         :=  \          background color                      96
  3  fg.color         :=  \          foreground color
  14 gr.color         :=  \
  10 em.color         :=  \          emphasized color
  10 outline.color    :=
  13 wa.color         :=                                                    101
;
: epson.black
   0            color.sft           :=
   2000         prn.scale           :=
   105          prn.no              :=                                    106
```

```
   0              pr.bg.color          :=  \           background color
   11 lc1 :=    15 lc2 :=    10 lc3 :=
   13 lc4 :=    12 lc5 :=    14 lc6 :=    15 lc7 :=
   pr.bg.color    vuport.color
   7              my.axis.color        :=                                  111
   my.axis.color  axis.color
   12             t1.color             :=
   14             t2.color             :=
   0  bg.color          :=  \           background color
   3  fg.color          :=  \           foreground color                    116
   14 gr.color          :=  \
   10 em.color          :=  \           emphasized color
   10 outline.color     :=
   13 wa.color          :=
;                                                                          121
: epson.color
   1              color.sft            :=
   2000           prn.scale            :=
 \ 105            prn.no               :=
   140            prn.no               :=  \ HP                            126
   15             pr.bg.color          :=  \           background color
 \ 11 lc1 :=    0 lc2 :=    10 lc3 :=    13 lc4 :=    12 lc5 :=    9 lc6 :=
    9 lc1 :=    12 lc2 :=    10 lc3 :=
   13 lc4 :=    0 lc5 :=    11 lc6 :=    0 lc7 :=
   pr.bg.color    vuport.color                                             131
   0              my.axis.color        :=
   my.axis.color  axis.color
   10             t1.color             :=
   0              t2.color             :=
   0  bg.color          :=  \           background color                    136
   3  fg.color          :=  \           foreground color
   14 gr.color          :=  \
   10 em.color          :=  \           emphasized color
   0  outline.color     :=
   13 wa.color          :=                                                  141
;
: select.color
  prn.flag
  case
    1 of   epson.black   endof                                             146
    2 of   epson.color   endof
    3 of   hp.laser      endof
  endcase
; select.color
                                                                           151
: my.def.colors
  color.on
  15 color
  bg.color background
  fg.color foreground                                                      156
; my.def.colors

: l.pro
  105  prn.no  =
  if                                                                       161
```



```
    dir.lee.txt " prompt-e.txt"  "cat  defer> load    \ for epson
  else
    dir.lee.txt " prompt.txt"  "cat  defer> load
  then
  dir.lee.txt " bell.txt"  "cat  defer> load                               166
; l.pro

: go00or11
  outline.color  cursor.color
  \ normal.coords   1.   1.   position                                     171
  normal.coords              position
  world.coords
;
: go00  0  0   go00or11 ;
: go11  1  1   go00or11  "  " label ;                                     176

integer scalar tmp.v.i
        scalar tmp.v.i.1
        scalar tmp.v.i.2
        scalar tmp.v.i.3                                                   181
        scalar tmp.v.i.4
        scalar tmp.v.i.9

real    scalar y.lab.pos
dp.real scalar tmp.v                                                       186
        scalar tmp.v.2
        scalar tmp.v.3
        scalar tmp.v.4
        scalar tmp.v.9
                                                                           191
60 string tmp.s
60 string tmp.s.9
60 string tmp.s.8
1  string xeq.flag
                                                                           196
: pro.sign.old  \   see prompt.txt
  \  "dir  " >>" "cat    "type
  15  foreground
  ." >>"
  \ \ \  my.def.colors                                                     201
;
\ dir.lee.txt " prompt.txt"  "cat  defer> load
\ dir.lee.txt " prompt-e.txt"  "cat  defer> load   \ for epson

: b.t        blink.toggle ;                                                206
: inv.of     inverse.off ;
: inv.on     inverse.on ;
: int.of     inten.off ;
: int.on     inten.on ;
: inv.text   inverse.on  "type  inverse.off           ;                    211
: int.text   inten.on    "type  inten.off             ;
: wan.text   wa.color  foreground  b.t    "type  b.t my.def.colors ;
: n.input    1   background  11  foreground  #input  my.def.colors ;
: s.input    200  msec.delay
             bell.1sl  4   background  11  foreground  "input              216
```

```
                my.def.colors ;
: n.type      1   background  15  foreground  .       my.def.colors ;
: s.type      4   background  15  foreground  "type   my.def.colors ;
: s.type.2    12   background  15  foreground  "type   my.def.colors ;
: s.type.3    5    background  14  foreground  "type   my.def.colors ;
: s.type.4    13   background  14  foreground  "type   my.def.colors ;
: cdt         dir.lee.txt "len 1 - "left  defer> chdir ;
: cdd         dir.lee.dat "len 1 - "left  defer> chdir ;
: cda         dir.lee.asc "len 1 - "left  defer> chdir ;
: sc          screen.clear ;
: vc          vuport.clear ;
: ftop        {29.line} screen.clear
              ." ---> :::: "       cda  s.input  defer>   pcx>vup
              cdt screen.clear previous.window ;
: ptof        {29.line} screen.clear
              ." ---> file : !! "  cda  s.input  defer>   vup>pcx
              cdt screen.clear previous.window ;
: ptof.bat    pcx.h.c.str  " y"  "=  if
              {29.line} screen.clear
              tmp.s  ":=   dir.lee.asc  tmp.s  "cat  tmp.s  ":=
              ." ---> file : ! "  tmp.s s.type   tmp.s  defer>   vup>pcx
              500 msec.delay
              cdt screen.clear previous.window  then ;
\ ------------------------------------------------------------------
integer scalar n>s.d1  scalar n>s.d2  scalar n>s.d3
real    scalar n>s1    scalar n>s2
1 string  n>s.s

: n>s
  n>s.d3          :=  \ #.digits
  n>s1            :=
  "null  n>s.s   ":=
  n>s1  0.  <  if   " -"  n>s.s  ":=  then
  n>s1  abs  n>s1  :=
  7 n>s.d1    :=
  begin
    \ 11 5 fix.format
    n>s1    10. n>s.d1    **   /  0.00001 +  trunc    n>s.d2    :=
    \ cr ." --1--" n>s1   n.type  n>s.d1    .   n>s.d2     n.type
    n>s.d1    1 -   n>s.d1    :=
    n>s.d2     0  <>
    n>s.d1     0  <    or
  until
  n>s.d2      48 +   ascii"
  n>s.d1     -1  =    n>s.d3       1 =   and
  if   exit   then
  n>s1      n>s.d2      10.  n>s.d1    1 + **   *  -  n>s1  :=
  n>s.d3        0 <>
  n>s.d1     -1 =   and
  if
    " ."   "cat   \ " ."  s.type
  then

  begin
    n>s1    10.  n>s.d1    **  /  0.00001 +  trunc     n>s.d2    :=
```



```
    \ cr  ." --2--" n>s1   n.type  n>s.d1    .   n>s.d2     n.type
    n>s.d1    1 -   n>s.d1    :=
    n>s.d1    -1 =   n>s.d3      1 =  and
    if  " 0"  "cat   exit  then
    n>s.d3       0          >
    n>s.d1      n>s.d3       <  and
    if
      n>s.d2      48 +   ascii"
      "cat
      begin
        " 0"  "cat
        \ cr  ." --3--"  n>s1   n.type  n>s.d1    .   n>s.d2     n.type
        n>s.d1    1 -   n>s.d1    :=
        n>s.d1      0  <
        if
          exit
        then
        1  1 <>
      until
    then
    n>s1   n>s.d2      10.  n>s.d1    1 + **   *  -   n>s1  :=
    n>s.d1      -2  =
    n>s.d3         0  =  and
    if
    else
      n>s.d2      48 +   ascii"   "cat
    then
  n>s.d1     -1 =
  if
    n>s.d3       0  <
    if
      " ."   "cat
    then
    \  " ."  s.type
  then
    n>s.d1     n>s.d3       <
  until
  n>s.s  " -"  "=  if  " -"  "swap  "cat  then
;
\ ------------------------------------------------------------------

: dashed1                                  solid  ;
: dashed2     0.019  0.004  0.019  0.004  dashed ;
: dashed3     0.011  0.004  0.011  0.004  dashed ;
: dashed4     0.006  0.005  0.006  0.005  dashed ;
: dashed5     0.003  0.003  0.003  0.003  dashed ;
: dashed6     0.014  0.004  0.005  0.004  dashed ;
: line.type   \ "  1--6"  s.type
              6    modulo
              case
              \   1  of  11  solid    endof  \ blue
              \   2  of  14  dashed2  endof  \ yellow
              \   3  of  10  dashed3  endof  \ green
              \   4  of  13  dashed4  endof  \ purple
              \   5  of  12  dashed5  endof  \ red
```

```
        \    0  of  15  dashed6  endof  \ white                          326
             1  of  lc1  dup    solid    endof
             2  of  lc2  dup    dashed2  endof
             3  of  lc3  dup    dashed3  endof
             4  of  lc4  dup    dashed4  endof
             5  of  lc5  dup    dashed5  endof                          331
             0  of  lc6  dup    dashed6  endof
             endcase
             line.c :=
             color    ;
\ : my.outline outline.color color outline ;                             336
: my.outline outline.color color  solid  outline ;
: yap        line.type  y.auto.plot   my.outline ;
: ydp        line.type  y.data.plot   my.outline ;
: xyap       line.type  xy.auto.plot  my.outline ;
: xydp       line.type  xy.data.plot  my.outline ;                       341
: fa         def.vuport normal.display  forget.all ;
: cd         cr ." Dir: "   s.input defer>   chdir ;
: nd         normal.display   install pro.sign.2   in prompt.xeq ;
: sd         stack.display    install pro.sign.2   in prompt.xeq ;
: sfp        cr ." File.parse: "  n.input  set.file.parse ;              346
: l          cr ." LOAD: " dir.lee.txt   s.input  "cat  defer> load ;
: l.o        cr ." Overlay name:  "  dir.asy.sys
             s.input  "cat  " .sov"  "cat  defer> load.overlay   cdt ;

1  string  x.axis.flag                                                   351
1  string  y.axis.flag
\ ------------------------------------------------------------
: xlyl
  horizontal    linear          " l"    x.axis.flag    ":=
  vertical      linear          " l"    y.axis.flag    ":=              356
;
: xlyo
  horizontal    linear          " l"    x.axis.flag    ":=
  vertical      logarithmic     " o"    y.axis.flag    ":=
;                                                                       361
: xoyl
  horizontal    logarithmic     " o"    x.axis.flag    ":=
  vertical      linear          " l"    y.axis.flag    ":=
;
: xoyo                                                                  366
  horizontal    logarithmic     " o"    x.axis.flag    ":=
  vertical      logarithmic     " o"    y.axis.flag    ":=
;
\ ------------------------------------------------------------
: xnyn                                                                  371
  horizontal    axis.fit.on
  vertical      axis.fit.on
;
: xnyf
  horizontal    axis.fit.on                                             376
  vertical      axis.fit.off
;
: xfyn
  horizontal    axis.fit.off
```



```
  vertical      axis.fit.on                                             381
;
: xfyf
  horizontal    axis.fit.off
  vertical      axis.fit.off
;                                                                       386
\ ------------------------------------------------------------

: get.val
             dup       n.type  ."  "
             250 msec.delay                                             391
             bell.1sl
             n.input
             if
               swap drop
             then ;                                                     396
: get.str
             "dup     s.type
             s.input
             "len  0  =
             if     "drop                                               401
             else   "swap  "drop
             then
;
\ ------------------------------------------------------------
: for.xyadp.p                                                           406
  -1 4  fix.format
  {29.line}  sc
  unrot     \  [ x  y  1  -  1  x  y ]
  " (bg.pt):"  s.type  1       get.val  tmp.v.i    :=
  " (end.pt):" s.type  []size  get.val  tmp.v.i.2  :=                   411
  " (inc):"    s.type  1       get.val  tmp.v.i.3  :=
  sub[ tmp.v.i , tmp.v.i.2  tmp.v.i - 1 + tmp.v.i.3 / , tmp.v.i.3 ]
     swap
  sub[ tmp.v.i , tmp.v.i.2  tmp.v.i - 1 + tmp.v.i.3 / , tmp.v.i.3 ]
     swap
  rot       \  [ 1  x  y  -  x  y  1 ]
  screen.clear  previous.window                                         416
;
: xyap.p
  for.xyadp.p
  xyap
;                                                                       421
: xydp.p
  for.xyadp.p
  xydp
;
                                                                        426
: mkl.p
             swap
             case
              1  of lc1 swap solid    1 -  2 *   endof
              2  of lc2 swap dashed2  1 -  2 *   endof                 431
              3  of lc3 swap dashed3  1 -  2 *   endof
              4  of lc4 swap dashed4  1 -  2 *   endof
```

```
              5  of lc5 swap dashed5  1 -  2 *   endof
              6  of lc6 swap dashed6  1 -  2 *   endof
            endcase                                                    436
            swap  color  key.line     ;
: mkl       \  interactive
            \  60  60  key.orig
            60  12  key.size
            " (key.orig/key.size) Line_#"     s.type  1    get.val     441
            "  Line_pos"  s.type  dup  get.val
            ." [...]"    s.input
            mkl.p  ;
: mkl.bat   \  [ line.# , line.pos , " text"  -- ]
            mkl.p  ;                                                   446
\ ------------------------------------------------------------------
: for.a.c.c&c.c.c
  []size integer  ramp          \ r-array size ramp   : (N + M - 1)
  rot
  []size swap  drop             \ input-array size    : (N)          451
  -                             \ shifted array index : -(N-1) to (M-1)
  s.freq float  /               \ convert to time
  swap
  " index_a , r_a created"  s.type
;                                                                      456
: a.c.c  \  [  array -  index_array  r_array  ]
  dup
  auto.correlation.coeff        \ give r-array
  for.a.c.c&c.c.c
;                                                                      461
: c.c.c  \  [ x_array  y_array  -  index_array  r_array  ]
  swap dup  rot  \  -> y x -> y x x  -> x x y
  \  dup  unrot  \  -> x y y -> y x y
  cross.correlation.coeff       \ give r-array
  for.a.c.c&c.c.c                                                      466
;
\ ------------------------------------------------------------------
\ actual # of sec's = 2 * #.sec
\ ------------------------------------------------------------------
                                                                       471
integer scalar  tmp.v.i.1  scalar #.fft.pts

: my.p.s.bat  \ [ array , sec_size , #.sec , window_type -- p.s.array ]
  tmp.s       ":=  \ window.type
  tmp.v.i.9    :=  \ #.sec                                             476
  tmp.v.i.1    :=  \ #.fft.pts
  tmp.v.i.1  #.fft.pts :=
  tmp.v.i.9   1   >
  if
    []size    tmp.v.i :=                                               481
    tmp.v.i  float   tmp.v.i.1 float 2. /   /
    floor 1 -      tmp.v.i.2  :=
\   tmp.v.i   tmp.v.i.1  /  2 *    1 -     tmp.v.i.2  :=
\   tmp.v.i   tmp.v.i  tmp.v.i.1  /  tmp.v.i.1 *    -
\   tmp.v.i.1  2 /                                                     486
\   >
\   if
```



```
\      tmp.v.i.2 1 +   tmp.v.i.2 :=
\   then
    tmp.v.i.2  tmp.v.i.9 >                                             491
    if
      tmp.v.i.9  tmp.v.i.2 :=
    then
  else
      tmp.v.i.9  tmp.v.i.2 :=                                          496
  then

  tmp.v.i.2   1  >
  if
    2  tmp.v.i.3    :=                                  \  with        501
       overlap
  else
    1  tmp.v.i.3    :=                                  \  no
       overlap
  then

  0                  \ initial sum                                     506
  swap               \ --> 0 , array

  tmp.v.i.2  1 +   1
  do
    \ cr i .                                                           511
    dup
    sub[ i 1 -    tmp.v.i.1  tmp.v.i.3 /   *    1 +   , tmp.v.i.1 ]
    \  dir.asy.sys  " timewins.sov"  "cat  defer>  load.overlay
    tmp.s "upper " X"  "=   if                          then
    tmp.s "upper " K"  "=   if   blackman.window.apply  then           516
    tmp.s "upper " B"  "=   if   bartlett.window.apply  then
    tmp.s "upper " N"  "=   if   hanning.window.apply   then
    tmp.s "upper " M"  "=   if   hamming.window.apply   then
    power.spectrum
    rot  \ --> array , p_s , 0                                         521
    +
    swap
  loop
  drop
                                                                       526
  2. *          \ Be sure to use only half length ( symmetry)
  []copy
  \ dup [ 1             ]   2. /   over [ 1             ]  :=
  \ dup [ tmp.v.i.1 2 / ]   2. /   over [ tmp.v.i.1 2 / ]  :=
  tmp.s  "upper " X"  "=                                               531
  if                    \ Correct the weight of data window --> make
     larger
    \ no operation
  else
    tmp.v.i.1
    tmp.s "upper " K" "= if   blackman.window  then                    536
    tmp.s "upper " B" "= if   bartlett.window  then
    tmp.s "upper " N" "= if   hanning.window   then
    tmp.s "upper " M" "= if   hamming.window   then
    2. ** []sum tmp.v.i.1 / \ The weight is not normalized --> use
```

```
      division
    /                                                                    541
  then
  tmp.v.i.2  float  /      \ averaged by actual #.sec
\ tmp.v.i.1  2 **   /      \
  tmp.v.i.1  1 **   /      \ normalized by #.fft.pts  -->  actual p.s
     density
\ release.overlay                                                        546
  sub[ 1 , tmp.v.i.1  2  / ]
;

: get.x.time   []size  ramp  s.freq float /   swap  ;
\ : get.x.freq   []size  ramp  s.freq float *  #.fft.pts float /  swap ;  551
: get.x.freq   []size  dup  ramp  s.freq float *  swap float 2. *  /
   swap ;
\ release.overlay
: my.p.s      \ [ array , sec_size , sections , window_type -- p.s.array
   ]
  cr " [ A , fft.pts , #.sec , wnd -- p.s.a ]" s.type
  my.p.s.bat                                                             556
  tmp.v.i.2  dup fft.sec :=   n.type   tmp.s  "dup wnd.str ":=   s.type
;
\ ---------------------------------------------------------------------
: c.2   \ [ x y   -  x y x y ]
  swap  \   y x                                                          561
  dup   \   y x x
  rot   \   x x y
  dup   \   x x y y
  rot   \   x y y x
  swap  \   x y x y                                                      566
;
\ ---------------------------------------------------------------------

\ ---------------------------------------------------------------------
: out.file                                                               571
  cr
  ." ---> File : "  s.type.2  s.input  cr
  ." Be sure to    "  b.t ." Out>file.close " b.t cr
  dir.lee.txt  "swap  "cat
  "dup "type   ."   <--- Created"                                        576
  defer>  out>file
  \  out>file.close
;
\ ---------------------------------------------------------------------
                                                                         581
graphics.display

vuport  h.port  0.0000 0.1500 vuport.orig  1.0000 0.8500 vuport.size
   outline
vuport  v.port  0.1800 0.1500 vuport.orig  0.6400 0.8500 vuport.size
   outline
vuport  l.port  0.0000 0.1500 vuport.orig  0.4800 0.8500 vuport.size     586
   outline
vuport  r.port  0.5200 0.1500 vuport.orig  0.4800 0.8500 vuport.size
   outline
```



```
vuport  u.port  0.0000 0.5800 vuport.orig  1.0000 0.4200 vuport.size
   outline
vuport  d.port  0.0000 0.1500 vuport.orig  1.0000 0.4200 vuport.size
   outline
vuport  f.port  0.2750 0.0334 vuport.orig  0.7250 0.9666 vuport.size  \
   outline
              \ (0 to 28 rows)                                           591
: port.axis.1
          horizontal  normal.coords  0.85  0.10  label.scale.point
             world.coords
                                     0     2     label.points
          vertical    normal.coords  0.07  0.87  label.scale.point
             world.coords
                                     0     2     label.points ;          596
: port.axis.2
          horizontal  normal.coords  0.85  0.10  label.scale.point
             world.coords
                                     0     2     label.points
          vertical    normal.coords  0.04  0.87  label.scale.point
             world.coords
                                     0     2     label.points ;          601
: port.color
          tmp.c foreground  tmp.c color
          pr.bg.color vuport.color  my.axis.color  dup  axis.color
             label.color
          go11 ;
: hp      h.port  {b.text}  t1.color tmp.c :=  port.axis.1  0.02          606
   y.lab.pos  :=
          port.color    0  2.wnd.flag := ;
: vp      v.port  {b.text}  t2.color tmp.c :=  port.axis.2  0.02
   y.lab.pos  :=
          port.color    0  2.wnd.flag := ;
: lp      l.port  {l.text}  t1.color tmp.c :=  port.axis.2  0.95
   y.lab.pos  :=
          port.color    1  2.wnd.flag := ;                               611
: rp      r.port  {r.text}  t2.color tmp.c :=  port.axis.2  0.95
   y.lab.pos  :=
          port.color          1  2.wnd.flag := ;
: up      u.port  {l.text}  t1.color tmp.c :=  port.axis.1  0.02
   y.lab.pos  :=
          port.color    1  2.wnd.flag := ;
: dp      d.port  {r.text}  t2.color tmp.c :=  port.axis.1  0.02          616
   y.lab.pos  :=
          port.color    1  2.wnd.flag := ;
: fp      f.port  {f.text}  t1.color tmp.c :=  port.axis.1  0.02
   y.lab.pos  :=
          port.color    0  2.wnd.flag := ;
: tc      {c.text}  screen.clear ;
                                                                         621
\  lp      outline
\  rp      outline
\  up      outline
\  dp      outline
\  hp      outline                                                       626
\  vp      outline
```

```
  {c.text}  echo.off  screen.clear      {b.text}  echo.on

: lab
  dup  999  <>                                                    631
  if
  -1  2  fix.format
  {29.line} screen.clear
  tmp.c            color
  tmp.c  foreground   ." X_pos:"    0   get.val  tmp.v    :=     636
  tmp.c  foreground   ." Y_pos:"    0   get.val  tmp.v.2  :=
  tmp.c  foreground   ." Center:"   0   get.val  tmp.v.3  :=
  tmp.c  foreground   ." [...]"         s.input  tmp.s    ":=
  tmp.c  foreground
  tmp.s                                                           641
  tmp.v    tmp.v.2            position
  tmp.v.3  0  <>
  if   centered.label
  else label
  then                                                            646
  normal.coords
  1.  1.  position
  world.coords
  screen.clear  previous.window
  bell.111                                                        651
  else
    drop  "drop "drop
  then
;
                                                                  656
: labxy.stack  \ [ x.lab  y.lab  y.pos -- ]
  dup  999  <>
  if
    "swap
    {29.line} screen.clear                                        661
    -1  2  fix.format
\   tmp.c            color
    0                color
    normal.coords
    0                          char.dir                           666
    0                          label.dir
    0.55    0.05               position
                               centered.label   \ [ "X ]
    90                         label.dir
    90                         char.dir                           671
    \ tmp.v  0.55              position
          0.55                 position
                               centered.label   \ [ "Y ]
    0                          char.dir
    0                          label.dir                          676
    1.  1.                     position
    world.coords
    screen.clear  previous.window
    bell.1sl
  else                                                            681
    drop  "drop "drop
```



```
  then
;

: labxy                                                           686
  tmp.c   color.sft +     foreground
  ." [X_s]"                s.input \ tmp.s    ":=
  tmp.c   color.sft +     foreground
  ."  [Y_s]"               s.input \ tmp.s    ":=
  tmp.c   color.sft +     foreground                              691
  ."  X_pos (0.02/0.95):" 0.02    get.val   \  tmp.v    :=
  tmp.c   color.sft +     foreground
  labxy.stack
;                                                                 696
\ : prompt.gd   ." >>" ;

: gd
  install pro.sign in prompt.xeq
  graphics.display                                                701
\  lp       outline
\  rp       outline
\  up       outline
\  dp       outline
\  hp       outline                                              706
\  vp       outline
  hp
  vuport.clear
  {29.line}
  screen.clear                                                    711
  \ ." H-V  L-R  U-D   F    port"
;

dir.asy.sys " genbd.sov"  "cat  defer>  load.overlay
: hp.printer                                                      716
  hp.laser
  145           bd.printer
  \ pr_clr_b      bd.pat
  pr_usr_bg     pr.bg.color   bd.uclr
;                                                                 721
: epson.printer.b
  epson.black
  105           bd.printer
  \ pr_clr_b      bd.pat
  pr_usr_bg     pr.bg.color   bd.uclr                           726
;
: epson.printer.c
  epson.color
  prn.no        bd.printer
  pr_clr_w      bd.pat                                          731
  pr_usr_bg     pr.bg.color   bd.uclr
;
: select.printer
  prn.flag
  case                                                            736
    1 of   epson.printer.b  endof
```

```
    2 of   epson.printer.c   endof
    3 of   hp.printer        endof
  endcase
;                                                                    741
: dump.p
  {29.line} screen.clear
  tmp.c            foreground
  tmp.c            color
  cr                                                                 746
  " ---> File : "   s.type.2
  s.input
  tmp.c            foreground
  "dup
  dir.asy.sys   " genbd.sov"  "cat  defer>  load.overlay             751
  cdt sc
  select.printer
  landscape    bd.page    \ <-- Compatable
  1500         1500 bd.scale
  dir.lee.txt  "swap  "cat  "type   ."    <--- Creating.  Please wait"  756
  bd.vuport    ?drop
  release.overlay
  screen.clear  previous.window
  bell.1ll
;                                                                    761

: dump.p.o.stack
  {29.line} screen.clear
  tmp.c            foreground
  \ "dup                                                             766
  dir.asy.sys   " genbd.sov"  "cat  defer>  load.overlay
  cda sc
  portrait  bd.page
  prn.scale   dup   bd.scale
  dir.lee.asc  "swap  "cat  "type   ."    <--- Creating.  Please wait"  771
  bd.vuport    ?drop
  release.overlay
  cdt screen.clear  previous.window
  bell.1ll
;                                                                    776
: dump.p.o.f
  {29.line} screen.clear
  tmp.c            foreground
  tmp.c            color
  cr                                                                 781
  " ---> File : "   s.type.2
  s.input
  "dup
  dump.p.o.stack
;                                                                    786
: dump.p.o.p    \ to printer  \ [ file.ext - ]
  {29.line} \ screen.clear
  dir.asy.sys   " genbd.sov"  "cat  defer>  load.overlay
  \ " lpt1" "dup
  "dup  tmp.v.i  0 n>s   " ."  "cat  "swap  "cat                     791
  " lpt1"
```



```
  prn.no           bd.printer
  dump.p.o.stack
;
: pbmp       \ to printer                                            796
  {29.line} \ screen.clear
  dir.asy.sys   " genbd.sov"  "cat  defer>  load.overlay
  " lpt1"
  prn.no           bd.printer
  gd hp outline                                                      801
  ftop    " ----- Please Wait ------" s.type
  bd.vuport
  my.def.colors
  release.overlay
;                                                                    806

release.overlay
\ ------------------------------------------------------------------
my.def.colors
                                                                     811
dir.asy.sys   " PCX.sov"  "cat  defer> load.overlay
: date.time
  graphics.display
  vp
  my.def.colors                                                      816
  dir.asy.sys   " PCX.sov"     "cat  defer> load.overlay
  dir.lee.txt   " boot.pcx"    "cat  defer> pcx>vup
  vp
  \  "     -----------   WELCOME   -----------"  s.type bell.1ll \ pckey
     ?drop  drop
  cr    "       ---------   WELCOME   --------"  s.type               821
  \ ." ---------  <"  "date "type ." > "
  cr  ."           <"  "date "type ." > "
  "time  "type     bell.1ll
  cr
  2500 msec.delay                                                    826
  release.overlay
  \  my.def.colors
  sd cdt
;
release.overlay                                                      831
\ ------------------------------------------------------------------
integer dim[ 6 ] array    acq.input
64 string mycase
32 string mydate
32 string mytime                                                     836
64 string specifics

INTEGER SCALAR T.RATE
        SCALAR s.length
     \  SCALAR s.freq                                               841
        SCALAR s.chnls
        SCALAR p.chnl
        SCALAR p.points
        scalar eps.flag
                                                                     846
```

```
: atof.p1
  dup  \  for .p3
  dup           []dims  tmp.v.i    :=  drop
  tmp.v.i  1  =  if  dup             []size    tmp.v.i.1 :=   drop  then
  tmp.v.i  2  =  if  dup          1  []dim     tmp.v.i.1 :=   drop          851
                                  2  []dim     tmp.v.i.2 :=   drop  then
;
: atof.p2  \ for interaction
  cr " ARRAY ---> FILE !! : "
  s.type.2                                                                 856
  bell.2sl
  s.input  \ cr
  dir.lee.asc  "swap  "cat   tmp.s  ":=
;
regular.datafile  \ dummy                                                  861
file.template
   8 comments
   integer dim[ 6 ] subfile
   real    dim[ 9 ] subfile   \ dummy
end                                                                        866
dir.lee.asc  " trash"  "cat  tmp.s  ":=
: atof.p3  \ c.d.tmp file
  cr
  tmp.s             defer>  file.create
  tmp.s             defer>  file.open                                      871
                                                    mycase           1 >
                                                       comment
                                                    mydate           2 >
                                                       comment
                                                    mytime           3 >
                                                       comment
                                                    specifics        4 >
                                                       comment
                                                    datafile.dat.p23 5 >   876
                                                       comment
  1 subfile  acq.input     array>file
  2 subfile                array>file
  file.close
  " OK" s.type   tmp.s  "type
;                                                                          881
: atof.p4
  regular.datafile
  file.template
  8 comments
  integer dim[ 6 ] subfile                                                 886
     tmp.v.i  1  =
     if
       real    dim[ tmp.v.i.1 ] subfile
     else
       real    dim[ tmp.v.i.1 , tmp.v.i.2 ] subfile                        891
     then
  end
;
: atof  \ [ array -- ]
  atof.P1                                                                  896
```



```
  atof.P2
  atof.p4
  atof.p3
;
: atof.bat  \ [ array , "name.ext" ---  ]                                  901
  atof.P1
  dir.lee.asc  "swap   "cat  tmp.s  ":=
  atof.p4
  atof.p3
;                                                                          906

\ ------------------------------------------------------------------
: ftoa.p1
  cr  " File( CDA/CDD? ) --> Unnamed ary : "
  s.type  bell.2sl                                                         911
  s.input   tmp.s  ":=   cr
;
: ftoa.p2
  tmp.s  defer> file.open
  1 comment>   mycase           ":=                                        916
  2 comment>   mydate           ":=
  3 comment>   mytime           ":=
  4 comment>   specifics        ":=
  5 comment>   datafile.dat.p23 ":=
  1 subfile    acq.input  file>array                                       921
               acq.input  [ 1  ] t.rate       :=
               acq.input  [ 2  ] s.length     :=
               acq.input  [ 3  ] s.freq       :=
               acq.input  [ 4  ] s.chnls      :=
               acq.input  [ 5  ] p.chnl       :=                          926
               acq.input  [ 6  ] p.points     :=
  2 subfile   file>unnamed.array
  file.close
  tmp.s  "type
  " OK" s.type  ."   "                                                     931
  cdt
;
: ftoa.bat  \  [ "name.ext"  -- array ]
  tmp.s  ":=
  ftoa.p2                                                                  936
;
: ftoa  \ for general directory
  ftoa.p1
  ftoa.p2
;                                                                          941
\ ------------------------------------------------------------------
\ array(s) to ASCII file
\ ------------------------------------------------------------------
integer scalar console.flag
        scalar format.flag                                                 946
        scalar atoa.flag
1               console.flag  :=
1               format.flag   :=       \ 1:fix.format1 ;     2:sci.format

: choose.format                                                            951
```

```
  12   5   fix.format
;
: atoa.p
  dir.lee.asc  "swap  "cat  cr
  "dup                                                              956
  "dup    defer>  delete  cr

  sc  0  0  goto.xy      "dup  s.type   ."   <--- Creating"
  defer>  out>file
  console.flag  0  =  if  console.off  then                         961
  4   0  fix.format
  []size  dup  .    cr
  1 +  1
  do
    4   0  fix.format                                               966
    i  .   ."   "
    tmp.v.i 1 +  1
    do
    \      format.flag  1 = if     10  4  fix.format
    \                       else   11  3  sci.format                971
    \                       then
      choose.format
      tmp.v.i  i - 1 +     pick  [ j ]  .
    loop  cr
  loop                                                              976
  tmp.v.i 1 +  1
  do
    drop
  loop
  out>file.close                                                    981
  console
  "type   ."   <--- Created"
;
: atoa.bat  \ [ array,  ... , file_name , #_array --  ]
  tmp.v.i  :=                                                       986
  atoa.p
;
: atoa
  cr
  ." Set  Choose.format  first"    cr                             991
  " #col:" s.type   1  get.val   tmp.v.i  :=
  " ---> File : "  s.type.2   " tmp.dat"  get.str
  atoa.p
;
\ ------------------------------------------------------------------  996
1024  stack  my.stack
      scalar #.xy

0     #.xy  :=
integer scalar file.no.g1  scalar file.no.g2  scalar file.no.g3     1001
        scalar file.no.g4  scalar file.no.g5  scalar file.no
1    file.no.g1   :=  1    file.no.g2   :=
1    file.no.g3   :=  1    file.no.g4   :=   1    file.no.g5   :=

: call.f.n.g1    file.no.g1  96 +   file.no.g1  1 +   file.no.g1  :=   ; 1006
```



```
: call.f.n.g2    file.no.g2  96 +   file.no.g2  1 +   file.no.g2  :=   ;
: call.f.n.g3    file.no.g3  96 +   file.no.g3  1 +   file.no.g3  :=   ;
: call.f.n.g4    file.no.g4  96 +   file.no.g4  1 +   file.no.g4  :=   ;
: call.f.n.g5    file.no.g5  96 +   file.no.g5  1 +   file.no.g5  :=   ;
: call.f.n       file.no     96 +   file.no     1 +   file.no     :=   ; 1011
: make.abc.all  \  [  file.no --  ]   ( "extention - )
  {29.line}   0  0  goto.xy
  \ ascii"              \   p  a
  0  n>s
  atoa.flag  1  =                                                   1016
  if
    "dup  "over  "swap       \   p  a  a  ->  p a a p ->  p a p a
  then
  dir.lee.asc    "swap "cat      " ." "cat    "swap "cat
  0  0  goto.xy  ." --->"    "dup  s.type                           1021
  hp          defer>    vup>pcx
  atoa.flag  1  =
  if
    {29.line}
    " -" "cat    "swap "cat    " .dat" "cat                         1026
    #.xy  2  *
    atoa.bat
    0  #.xy  :=
  then
  cdt          sc         previous.window                         1031
;
: make.abc.g1      call.f.n.g1     make.abc.all   ;   \  [  - ]  ( "ext
  - )
: make.abc.g2      call.f.n.g2     make.abc.all   ;
: make.abc.g3      call.f.n.g3     make.abc.all   ;
: make.abc.g4      call.f.n.g4     make.abc.all   ;                 1036
: make.abc.g5      call.f.n.g5     make.abc.all   ;
\ : make.abc         call.f.n        make.abc.all   ;
: make.abc         file.no          make.abc.all
             file.no 1 +  file.no :=   ;
                                                                   1041
: ftop.bat  {29.line} screen.clear
            " ---> :::: "  s.type.2   cda  "dup  s.type  defer> pcx>vup
            cdt              previous.window
;
\ ------------------------------------------------------------------  1046

\ ------------------------------------------------------------------
\ DO NOT USED IN WINDOWS
\ dir.asy.sys  " runtime.aov"  "cat  defer> load.overlay
\ banner: my.banner                                                1051
\  graphics.display
\  vp
\  \ dir.asy.sys  " PCX.sov"    "cat  defer> load.overlay
\  dir.lee.txt  " boot.pcx"   "cat  defer> pcx>vup
\  \ release.overlay                                               1056
\  bell.1LL
\  \ cr ." ---------  <"  "date "type ." > "
\  \  "time  5 "left  "type  ."   LEE  ---------"   pckey ?drop  drop
\  cr ." ----------  <"  "date "type ." > "
```

```
\  "time  5 "left  "type  ."   -----------"   pckey ?drop  drop
\  \ 4000 msec.delay
\  nd
\ ;banner
\ release.overlay
\
   ------------------------------------------------------------------------


: run.menu
  dir.lee.txt  " lee.men"      "cat  defer> load
  cr  prompt.xeq space
;
: run.acq.spe
  dir.lee.txt  " lacq-spe.men"      "cat  defer> load
  cr  prompt.xeq space
;
\ : lref-0 ;  \ dummy
\ : lsta-0 ;
: run.lref-0
  dir.lee.txt  " lref-0.txt"      "cat  defer> load
  \ forget lref-0
  cr  prompt.xeq space
;
\ F1 shift  function.key.does  run.menu

01 control.key.does  run.menu
17 control.key.does  run.acq.spe

install nop          in bell
install pro.sign     in prompt.xeq

" y"  my.pause.flag   ":=
: my.pause
  my.pause.flag  " y"   "=
  if
    \    bell.flag
    \    1  bell.flag :=
    bell.1sl
    {29.line}  sc
    0  1  goto.xy   " <Press Key>"  s.type
    pckey  drop ?drop
    0  1  goto.xy  ."            "
    previous.window
    \    bell.flag :=  \ restore
  then
;
 1 string cdtnow.flag.str
32 string cdt.now.str
32 string cda.now.str
32 string cdd.now.str
32 string cdf.now.str
\ my.pause
: cdtNow
```



```
  cdt.now.str "len 1 - "left defer> chdir
;
: cdaNow
  cda.now.str "len 1 - "left defer> chdir
;
: cddNow
  cdd.now.str "len 1 - "left defer> chdir
;
: cdfNow
  cdf.now.str "len 1 - "left defer> chdir
;

: SWD \ set working directories
  cdt load SWD.asy
;
\ 12 string tmp.s.defer
\ : defer.load.get \ [ " - ]
\   get.str tmp.s.defer ":=
\   tmp.s.defer defer> load
\ ;
: stack.data ; \ dummy for input gathering of asy data, wks files
: stack.load ; \ dummy for input gathering of asy txt files

token   t1   exp.mem>   t1
token   t2   exp.mem>   t2
token   t3   exp.mem>   t3
token   t4   exp.mem>   t4
token   t5   exp.mem>   t5
token   t6   exp.mem>   t6
token   t7   exp.mem>   t7
token   t8   exp.mem>   t8
my.def.colors

dir.lee.txt " Eps-AOv.asy"  "cat  defer> load

0 set.file.parse
\ sd SWD
my.pause

\ : WC.all.sel
\ bell fa cr stack.load " SC-Run.sel" "dup s.type.2 swd cr
\ cdtNow defer> load \ Spectral Coherence
\ \ ------------------------------------------------------------
\ bell fa cr stack.load " CWT-Run.sel" "dup s.type.2 swd cr
\ cdtNow defer> load \ CWT
\ \ ------------------------------------------------------------
\ bell fa cr stack.load " WPM-Run.sel" "dup s.type.2 swd cr
\ cdtNow defer> load \ Wavelet Package Map
\ \ ------------------------------------------------------------
\ bell fa cr stack.load " WC-Run.sel" "dup s.type.2 swd cr
\ cdtNow defer> load \ Wavelet Coherence
\ bell fa cr stack.load " WC-A-Plt.sel" "dup s.type.2 swd cr
\ cdtNow defer> load \ Plot All WC Curves
\ \ ------------------------------------------------------------
\ bell fa cr stack.load " PsiC-Run.sel" "dup s.type.2 swd cr
```

```
\ cdtNow defer> load \ Generate Psi Curve WKS file
\ bell fa cr stack.load " PsiC-Plt.sel" "dup s.type.2 swd cr
\ cdtNow defer> load \ Plot Psi Curve
\ cr "   CONGRATULATION!" S.type.2
\ ;
\ \ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
: WC.all.sel
bell fa cr stack.load " R-SCoh.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Spectral Coherence
\ ---------------------------------------------------------------
bell fa cr stack.load " R-WCoh.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Wavelet Coherence
bell fa cr stack.load " P-WCoh-A.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Plot All WC Curves
\ ---------------------------------------------------------------
bell fa cr stack.load " R-Rdg.sel" "dup s.type.2 swd cr
cdtNow defer> load \ CWT
\ ---------------------------------------------------------------
bell fa cr stack.load " R-WPM.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Wavelet Package Map
\ ---------------------------------------------------------------
bell fa cr stack.load " R-PsiC.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Generate Psi Curve WKS file
bell fa cr stack.load " P-PsiC.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Plot Psi Curve
\ ---------------------------------------------------------------
bell fa cr stack.load " R-Ent.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Spectral Coherence
\ ---------------------------------------------------------------
bell fa cr stack.load " R-Nor.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Spectral Coherence
\ ---------------------------------------------------------------
bell fa cr stack.load " R-Pha.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Spectral Coherence
\ ---------------------------------------------------------------
bell fa cr stack.load " R-DnR.sel" "dup s.type.2 swd cr
cdtNow defer> load \ Spectral Coherence
\ ---------------------------------------------------------------
cr "   CONGRATULATION!" S.type.2
;
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\ ================================================================
: Sta.all.sel
bell fa cr stack.load " LSta-O.asy" "dup s.type.2 cr swd
cdt defer> load \ Statistics
bell fa cr stack.load " LWHP-O.asy" "dup s.type.2 cr swd
cdt defer> load \ Probability Distribution of Zero-up wave heights
\ ---------------------------------------------------------------
bell fa cr stack.load " LRef-O.asy" "dup s.type.2 cr swd
cdt defer> load \ Reflection Coefficients
\ ---------------------------------------------------------------
bell fa cr stack.load " LPlt-O.asy" "dup s.type.2 cr swd
cdt defer> load \ Plot Wave Signal
\ ---------------------------------------------------------------
```



```
bell fa cr stack.load " ACC-Exp.asy" "dup s.type.2 cr swd
cdt defer> load \ Auto Correlation Coefficients
\ ---------------------------------------------------------------
cr "   CONGRATULATION!" S.type.2
;

sd cdt
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

123-A2W.asy

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```
: 123-A2W.asy ; \ %----- Asyst Prog                                        1
\ : To123.asy ; \ %----- Asyst Prog

integer scalar to.stack.flag  scalar to.123.flag  scalar gp.flag
        scalar col.inc        scalar col.no       scalar row.no
        scalar to.123.999.flag                                            6

32 string 123.file.name
32 string 123.file.name.1
32 string 123.file.name.2
32 string 123.file.now                                                   11
3  string file.ext
\ 14 string d&t.string

real  dim[ 20 ] array 123.ary.tmp
token 123.ary.n   exp.mem> 123.ary.n                                     16
token 123.ary.n2  exp.mem> 123.ary.n2
dim[ 4 , 64 ]  string.array 123.ary.s
dim[ 4 , 32 ]  string.array 123.ary.s2

0  to.stack.flag :=                                                      21
1  to.123.flag   :=
1  gp.flag       :=
1  file.no       :=
10 col.inc       :=
                                                                         26
dir.lee.asc " 000.wks" "cat 123.file.name ":=

dir.asy.sys       " 123io.sov" "cat       defer>  load.overlay

: set.123.BP \ [" Str1"  " Str2" - ]                                     31
  \ {29.line}
  123.file.name.2  ":=
  123.file.name.1  ":=
  dir.lee.asc 123.file.name.1 "cat 123.file.name.1 ":=
  dir.lee.asc 123.file.name.2 "cat 123.file.name.2 ":=                   36
  dir.asy.sys       " 123io.sov" "cat       defer>  load.overlay
  123.file.name.1    defer>  123file.create
  123.file.name.2    defer>  123file.create
  123.file.name.1  123.file.name ":=
  release.overlay                                                        41
;
: set.123
  {29.line}
  123.file.name
  dir.lee.asc "len  1 +   "drop                                          46
  "dup "len "drop  dir.lee.asc "len "drop -  "sub  123.file.name.1 ":=
  dir.asy.sys       " 123io.sov" "cat       defer>  load.overlay
  dir.lee.asc
  \ cr  ." 123 file 1 name:"  " 123.wks"    get.str
  cr  ." 123 file 1 name (close all wks files first!):"                  51
  123.file.name.1  get.str
```



```
  "cat   123.file.name.1  ":=
  dir.lee.asc
  cr  ." 123 file 2 name:"  " 1234.wks"  get.str
  "cat   123.file.name.2  ":=                                            56
  cr  ." Group flag:"  gp.flag  get.val  gp.flag :=
  cr  ." file.no:"     file.no  get.val  file.no :=
  123.file.name.1      defer>  123file.create
  123.file.name.2      defer>  123file.create
  cr  ." Initial all WKS files (Yes:999)!!:" 0  get.val                  61
  999 =
  if
    dir.lee.asc  " le"     "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " me"     "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " so"     "cat  " .wks" "cat  defer> 123file.create     66
    dir.lee.asc  " ona"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " ons"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " bo1"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " bo2"    "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " bo3"    "cat  " .wks" "cat  defer> 123file.create     71
    dir.lee.asc  " 1234"   "cat  " .wks" "cat  defer> 123file.create
    dir.lee.asc  " 123999" "cat  " .wks" "cat  defer> 123file.create
  then
  123.file.name.1  123.file.name ":=
  release.overlay                                                        76
;
: to.stack
  to.stack.flag 1 =
  if
    \ dup                                                                81
  else
    drop
  then
;
: to.123 \ [ - ]                                                         86
  \ Use 123.file.name
  \ Put data   in 123.ary.n
  \ Put String in 123.ary.s
  \ Specify  fine.no,  gp.flag,  and  col.inc
  to.123.flag 1 =                                                        91
  if
    dir.asy.sys       " 123io.sov" "cat  defer>  load.overlay
    123.file.name     defer>  123file.open
    1    file.no   gp.flag  1 -  col.inc *   +  123write.down
    \ 123.ary.s  "[ 1 ] ">123file                                        96
    \ ---------------------------------------
    "date " -" "cat "time "cat 123.ary.s "[ 4 ] ":=
    \ ---------------------------------------
    123.ary.s           ">123file \ Modified for DnR
    \    2    file.no   gp.flag  1 -  col.inc *   +  123write.down       101
    11    file.no   gp.flag  1 -  col.inc *   +  123write.down
    123.ary.n     array>123file
    defer>  123file.close
  then
  cr 123.file.name  s.type                                               106
  release.overlay
```

```
;
: to.123.1
  123.file.name.1  123.file.name ":=
  to.123                                                    111
;
: to.123.2
  123.file.name.2  123.file.name ":=
  to.123
;                                                           116
: to.123.999
  to.123.999.flag 1 =
  if
    dir.asy.sys        " 123io.sov" "cat  defer>  load.overlay
    dir.lee.asc " 123999.wks" "cat  defer>  123file.open    121
    row.no   file.no  gp.flag  1 -  col.inc *   +  123write.down
    ">123file
    defer>  123file.close
    row.no 1 +  row.no :=
    release.overlay                                         126
  then
\ cr 123.file.name  s.type
;

: ato123.int                                                131
  cr ." Array in stack to 123 (Interactive):"
  dir.asy.sys        " 123io.sov" "cat  defer>  load.overlay
  dir.lee.asc
  cr ." WKS file name:"  " 123TMP.wks"  get.str  "cat
  cr "dup  \ "type                                          136
  "dup  defer>   delete
  "dup  defer>   123file.create
        defer>   123file.open
  cr ." Row:"  1  get.val
  cr ." col:"  1  get.val                                   141
  cr ." Across(a)|Down(d):" " D"  get.str

  \   [Array, Row, Col, Across(1)|Down(2) -]"
  \  1  =
  "upper  " A"  "=                                          146
  if
    123write.across
  else
    123write.down
  then                                                      151
  array>123file
  defer>  123file.close
  release.overlay
  cr  "type  "  OK" s.type
;                                                           156

: ato123 \ [Array, Row, Col, Across(a)|Down(d) -]
  cr ." Array to 123: [Array, Row, Col, Across(a)|Down(d) -]"
  dir.asy.sys        " 123io.sov" "cat  defer>  load.overlay
  dir.lee.asc                                               161
```



```
  cr ." WKS file name:" " 123TMP.wks"  get.str  "cat
  cr "dup \ "type
  "dup  defer>   delete
  "dup  defer>   123file.create                             166
        defer>   123file.open
  \  1  =
  "swap
  "upper  " A"  "=
  if                                                        171
    123write.across
  else
    123write.down
  then
  array>123file                                             176
  defer>  123file.close
  release.overlay
  cr  "type  "  OK" s.type
;                                                           181

integer scalar row.beg
integer scalar col.beg
1 string a.or.d

: ato123.bat.ini                                            186
  dir.asy.sys        " 123io.sov" "cat  defer>  load.overlay
  cr  ." Array to 123: [File, String, Array, Row, Col, Across( a)|Down(
      d)]"
  \  " c:\per\asy\asc\tmp2.wks"   tmp.s.9  ":=
  dir.lee.asc  "dup  s.type  cr  " 123tmp.wks"  get.str   "cat  tmp.s.9
       ":=
  tmp.s.9   "dup s.type    defer>   delete                  191
  tmp.s.9                  defer>   123file.create
  release.overlay
;
: ato123.bat
  dir.asy.sys        " 123io.sov" "cat  defer>  load.overlay  196
  col.beg  :=
  row.beg  :=
  a.or.d  ":=
  123.ary.s  "[ 1 ]  ":=
  tmp.s.9  ":=                                              201
  tmp.s.9  defer>   123file.open
  a.or.d
  " a"  "=
  if
    123.ary.s                                               206
    row.beg       col.beg
    123write.across
    ">123file
    row.beg       col.beg  1 +
    123write.across                                         211
    array>123file
  else
    123.ary.s
    row.beg       col.beg
```

```
    123write.down                                                    216
    ">123file
    \     row.beg 1 +    col.beg
    row.beg 10 +    col.beg
    123write.down
    array>123file                                                    221
  then
  tmp.s.9  defer>  123file.close
  release.overlay
;
                                                                     226
: a2wks
  dir.asy.sys        " 123io.sov" "cat  defer>  load.overlay
  \  dir.lee.asc
  cr ." Array to WKS --- Does the file exist?"
  cr ." ---> " " [file.name, String, Array, Col -- ]"  s.type.3     231
  "swap
  dir.lee.asc   "swap  "cat
           defer>   123file.open
  dup
  1          swap                                                  236
  123write.down
  ">123file
  1 10 +     swap
  123write.down
  array>123file                                                    241
  \  defer>  123file.close
  123file.close
  release.overlay
;
                                                                     246
release.overlay
: hint
cr  ."   Usages:"
cr  ."     (1) (old wks destroyed) [ array - ]     ato123.int"
cr  ."     (2) (old wks destroyed) [ array  row  col  'A/D' ]     ato123"  251
cr  ."     (3) (set.123 once)      [ wks.file.name  str array col ]
    a2wks"
;

: app.ramp.col
  " $$[("  file.no 0 n>s "cat  " ," "cat                           256
  123.ary.n []size swap drop 10 + 0 n>s "cat
  " )<" "cat
  \ ------------------------------------- ■
  \ \ $$[(5,1034)<1024>]
  123.ary.n []size swap drop 0 n>s                                 261
  \ ------------------------------------- ■
  \ \ $$[(5,1034)<Level:2-Pt4,Power:10,Element:12>]
  \ " Level:" jwp.level 0 n>s "cat
  \ " -Pt" "cat 2 jwp.level ** 0 n>s "cat
  \ " ,Power:" "cat n.power 0 n>s "cat                             266
  \ " ,Element:" "cat i.ele 0 n>s "cat
  \ ------------------------------------- ■
  "cat
```



```
  " >]" "cat
  123.ary.s "[ 1 ]  ":=                                            271
  \
  123.ary.n []size swap drop real ramp 1.0 * becomes> 123.ary.n
  \
  to.123
  file.no 1 + file.no := \ post inc of column                      276
;
```

.....

P-WCoh-A.shl

A01775-20161209-A029 ❖ December 9, 2016 ❖ [Page count: 4]

```
: WC-A-Plt.sel ; \ %----- Asyst Prog

\ ^--------------------------------------------------------------------
\ \\ ------------------------------------------------------------------
\ %% String assignment
\     0.  misce.str -- at Top Left, can be assigned in FB(2)
\     1.  spe.str.1 -- provided by wks file (element at first row and
   last column)
\     2.  spe.str.2 or spe.str.3 -- (CASE) above Legend, use
   spe.str.2.or.3
\           spe.str.2: can be assigned in FB(2)
\           spe.str.3: default to eps.file.name, not changeable, see
   plot.bat
\     3   123.str.ary or lgn.str.ary -- Legends for lines, use
   get.lgns.a.or.d
\           123.str.ary: provided by wks file (first row)
\           lgn.str.ary: can be assigned in FB2
\ \\ ------------------------------------------------------------------
\ ^--------------------------------------------------------------------

fa sd swd

cdt load FigAPlot.shl \
\ \ ================================================================
\ 1  string output.flag.str
\ 26 string d&t.string
\ 14 string new.d&t.string
\
\ integer scalar new.d&t.flag
\
\ 1 new.d&t.flag  := \ 0: default now, 1: assigned
\
\ : set.new.d&t \ [ "str -- ]
\   new.d&t.flag 1 =
\   if
\     new.d&t.string    ":=
\   else
\     "drop  \ use default
\   then
\ ;
\
\ cdtNow load WD.asy
\
\ : Chose.output
\   cr ." Chose output format:"
\   cr ."                       M: Monitor"
\   cr ."                       E: EPS"
\   cr ."                       " " M" get.str
\   "dup s.type
\   output.flag.str ":=
\ ;
\ Chose.output
```



```
\ ================================================================
: Forget.mark ;

\ ================================================================

: file.name
  stack.data " C1AC-CC.wks" \ Coh - Wave Current (Spectral) - A series
  stack.load " C-CC-A.bpf"
;
cdt load FigAPlot.asy

: file.name
  stack.data " C4FC-Px.wks" \ Coh - Wave Current (Spectral) - A series
  stack.load " C-Fx.bpf" \ No phase adjustment
;
cdt load FigAPlot.asy

: file.name
  stack.data " C-WCs-A.wks" \ Coh - Wave Current (Spectral) - A series
  stack.load " C-WCs-A.bpf"
;
" 08/20/98-12:30"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot

forget file.name
: file.name
  stack.data " C-WCs-9F.wks"
  stack.load " C-WCs-9F.bpf"
;
" 08/21/98-15:52"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot

forget file.name
: file.name
  stack.data " C-WCs-4F.wks"
  stack.load " C-WCs-4F.bpf"
;
" 08/21/98-15:52"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot

forget file.name
: file.name
  stack.data " C-WCs-2F.wks"
  stack.load " C-WCs-2F.bpf"
;
" 08/21/98-15:52"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot

forget file.name
: file.name
```

```
  stack.data " C-WCs-1F.wks"
  stack.load " C-WCs-1F.bpf"
;                                                                    106
" 08/21/98-15:52"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot

forget file.name                                                     111
: file.name
\   stack.data " C1BnQxCC.wks" \ Coh - B & Q series - Phase X - Cur-Cur
\   stack.data " C1BnQ-CC.wks" \                    -Phase Optimize
  stack.data " C-CC-BnQ.wks" \ Coh - Current Current - B and Q series
  stack.load " C-CC-BnQ.bpf"                                         116
;
" 08/21/98-17:02"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot
                                                                     121
forget file.name
: file.name
  stack.data " C-WC-BMC.wks" \ Coh - Wave Cur - B series - Modified
     Complex
  stack.load " C-WC-B-M.bpf" \
;                                                                    126
" 08/21/98-17:02"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot

forget file.name                                                     131
: file.name
  stack.data " C-WC-1FC.wks"
  stack.load " C-WC-1F.bpf"
;
" 08/22/98-00:33"  set.new.d&t                                       136
cdt load FigAPlot.asy
\ mon.plot

forget file.name
: file.name                                                          141
  stack.data " C-WC-2FC.wks"
  stack.load " C-WC-2F.bpf"
;
" 08/22/98-00:33"  set.new.d&t
cdt load FigAPlot.asy                                                146
\ mon.plot

forget file.name
: file.name
    stack.data " C-WC-4FC.wks"                                       151
    stack.load " C-WC-4F.bpf"
;
" 08/22/98-00:33"  set.new.d&t
cdt load FigAPlot.asy
\ mon.plot                                                           156
```



```
forget file.name
: file.name
  stack.data " C-WC-A-R.wks" \ Coh - Wave Cur - A series - Real
  stack.load " C-WC-A.bpf"                                           161
;
" 08/22/98-14:30"  set.new.d&t
cdt load FigAPlot.asy \
\ mon.plot
                                                                     166
\ ---------------------------------------------------------------------
\ =====================================================================
\ ---------------------------------------------------------------------

: All.file.name                                                      171
  \  " n"       1x1y.flag  ":=
  \ ---------------------------------------
  \   wks.file.name      FB2.file.name
  \ ---------------------------------------
  " C-WC-BRC.wks"      " C-WC-B-M.bpf"                               176
  " C-WCs-A.wks"       " C-WCs-A.bpf"
  " C-WCs-9F.wks"      " C-WCs-9F.bpf"
  " C-WCs-4F.wks"      " C-WCs-4F.bpf"
  " C-WCs-2F.wks"      " C-WCs-2F.bpf"
  " C-WCs-1F.wks"      " C-WCs-1F.bpf"                               181
  " C-SC-.wks"         " C-SC-.FB2"
  " C-WC-BRC.wks"      " C-WC-B-M.bpf"
  " C-CC-BnQ.wks"      " C-CC-BnQ.bpf"
  " C-WC-BMC.wks"      " C-WC-B-M.bpf"
  " C-WC-B_C.wks"      " C-WC-B.FB2"                                 186
  " C-WC-B_R.wks"      " C-WC-B.FB2"
  " C-WC-1FC.wks"      " C-WC-1F.bpf"
  " C-WC-2FC.wks"      " C-WC-2F.bpf"
  " C-WC-4FC.wks"      " C-WC-4F.bpf"
  " C-WC-F4r.wks"      " C-WC4F.FB2"       \ use ymax=0.5           191
  " C-WC-A_C.wks"      " C-WC-A.FB2"
  " C-WC-A-R.wks"      " C-WC-A.bpf"
  " C-model.wks"       " C-WC-A.FB2"       \ use " C-WC-A-R.wks"
  " C-psi1or.wk1"      " C-psi1or.FB2"     \ Re & Im parts of wavelets
     bat1
  " C-psi2or.wk1"      " C-psi2or.FB2"     \ Re & Im parts of wavelets  196
     bat2
  " C-psi-ol.wk1"      " C-psi-ol.FB2"     \ Re & Im parts of wavelets
     bat3
  \ " MorletRI.wk1"      " C-psi-ol.FB2"   \ Re & Im parts of wavelets
  " C-WC-R1A.wks"      " C-WC-A.FB2"       \ sai=50~5.5  a series
  " C-WC-R0A.wks"      " C-WC-A.FB2"       \    =11~5.5  a
  " C-WC-R-A.wks"      " C-WC-A.FB2"                                 201
  \ " C-WC-C2p.wks"
  \ " C-WC-C.wks"
  \ " C-WC-R.wks"
;
\ =====================================================================  206
```

P-Pha.shl

A01776-20161209-A030 ❖ December 9, 2016 ❖ [Page count: 6]

```
: Plot.Phase.shell ; \  -*- txt:asy -*-

\ ^--------------------------------------------------------------------
\ \\ ------------------------------------------------------------------
\ %% String assignment
\     0.  misce.str -- at Top Left, can be assigned in FB(2)
\     1.  spe.str.1 -- provided by wks file (element at first row and
   last column)
\     2.  spe.str.2 or spe.str.3 -- (CASE) above Legend, use
   spe.str.2.or.3
\           spe.str.2: can be assigned in FB(2)
\           spe.str.3: default to eps.file.name, not changeable, see
   plot.bat
\     3   123.str.ary or lgn.str.ary -- Legends for lines, use
   get.lgns.a.or.d
\           123.str.ary: provided by wks file (first row)
\           lgn.str.ary: can be assigned in FB2
\ \\ ------------------------------------------------------------------
\ ^--------------------------------------------------------------------

fa sd swd

cdt load FigAPlot.sel \
\ \ ================================================================
\ 1  string output.flag.str
\ 26 string d&t.string
\ 14 string new.d&t.string
\
\ integer scalar new.d&t.flag
\
\ 1 new.d&t.flag  := \ 0: default now, 1: assigned
\
\ : set.new.d&t \ [ "str -- ]
\   new.d&t.flag 1 =
\   if
\     new.d&t.string    ":=
\   else
\     "drop  \ use default
\   then
\ ;
\
\ cdtNow load WD.asy
\
\ : Chose.output
\   cr ." Chose output format:"
\   cr ."                       M: Monitor"
\   cr ."                       E: EPS"
\   cr ."                       " " M" get.str
\   "dup s.type
\   output.flag.str ":=
\ ;
\ Chose.output
```



```
\ ================================================================
: Forget.mark ;

\ ================================================================

: file.name
\   stack.data " Phase-A.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.data " Pha-LEME.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-LEME.BPF"
;
cdt load FigAPlot.asy \
forget file.name

: file.name
\   stack.data " Phase-A.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.data " Pha-SOD.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-SOD.BPF"
;
cdt load FigAPlot.asy \
forget file.name

: file.name
  stack.data " Pha-ONA1.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-ONA1.BPF"
;
cdt load FigAPlot.asy \
forget file.name

: file.name
  stack.data " Pha-ONA2.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-ONA2.BPF"
;
cdt load FigAPlot.asy \
forget file.name

: file.name
  stack.data " Pha-ONS1.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-ONS1.BPF"
;
cdt load FigAPlot.asy \
forget file.name

: file.name
  stack.data " Pha-ONS2.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-ONS2.BPF"
;
cdt load FigAPlot.asy \
forget file.name

: file.name
  stack.data " Pha-ONC.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-ONC.BPF"
;
cdt load FigAPlot.asy \
```

```
forget file.name

: file.name                                                                    106
  stack.data " Pha-BO11.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-BO11.BPF"
;
cdt load FigAPlot.asy \
forget file.name                                                               111

: file.name
  stack.data " Pha-BO12.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-BO12.BPF"
;                                                                              116
cdt load FigAPlot.asy \
forget file.name

: file.name
  stack.data " Pha-BO21.WKS" \ Coh - Wave Current (Spectral) - A series        121
  stack.load " Pha-BO21.BPF"
;
cdt load FigAPlot.asy \
forget file.name
                                                                               126
: file.name
  stack.data " Pha-BO22.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-BO22.BPF"
;
cdt load FigAPlot.asy \                                                        131
forget file.name

: file.name
  stack.data " Pha-BO31.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-BO31.BPF"                                                   136
;
cdt load FigAPlot.asy \
forget file.name

: file.name                                                                    141
  stack.data " Pha-BO32.WKS" \ Coh - Wave Current (Spectral) - A series
  stack.load " Pha-BO32.BPF"
;
cdt load FigAPlot.asy \
forget file.name                                                               146

\ ================================================================
\ ================================================================

\ : file.name                                                                  151
\   stack.data " Cs1A-CC.wks" \ Coh - Current Current - B and Q series
\   stack.load " CsCC-A.bpf"
\ ;
\ cdt load FigAPlot.asy
                                                                               156
\ : file.name
\   stack.data " C4FC-Px.wks" \ Coh - Wave Current (Spectral) - A series
```



```
\   stack.load " C-Fx.bpf" \ No phase adjustment
\ ;
\ cdt load FigAPlot.asy                                                        161

\ : file.name
\   stack.data " Cs1A-WC.wks" \ Coh - Wave Current (Spectral) - A series
\   stack.load " C-A.bpf"
\ ;                                                                            166
\ " 08/20/98-12:30"  set.new.d&t
\ cdt load FigAPlot.asy

\ : file.name
\   stack.data " Cs1A-WC.wks" \ Coh - Wave Current (Spectral) - A series       171
\   stack.load " C-WCs-A.bpf"
\ ;
\ " 08/20/98-12:30"  set.new.d&t
\ cdt load FigAPlot.asy
                                                                               176
\ : file.name
\   stack.data " C-WCs-A.wks" \ Coh - Wave Current (Spectral) - A series
\   stack.load " C-WCs-A.bpf"
\ ;
\ " 08/20/98-12:30"  set.new.d&t                                               181
\ cdt load FigAPlot.asy

\
\ forget file.name
\ : file.name                                                                  186
\   stack.data " C-WCs-9F.wks"
\   stack.load " C-WCs-9F.bpf"
\ ;
\ " 08/21/98-15:52"  set.new.d&t
\ cdt load FigAPlot.asy                                                        191
\ \ mon.plot
\
\ forget file.name
\ : file.name
\   stack.data " C-WCs-4F.wks"                                                 196
\   stack.load " C-WCs-4F.bpf"
\ ;
\ " 08/21/98-15:52"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot                                                                   201
\
\ forget file.name
\ : file.name
\   stack.data " C-WCs-2F.wks"
\   stack.load " C-WCs-2F.bpf"                                                 206
\ ;
\ " 08/21/98-15:52"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot
\                                                                              211
\ forget file.name
\ : file.name
```

```
\   stack.data " C-WCs-1F.wks"
\   stack.load " C-WCs-1F.bpf"
\ ;                                                                    216
\ " 08/21/98-15:52"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot
\
\ forget file.name                                                     221
\ : file.name
\ \   stack.data " C1BnQxCC.wks" \ Coh - B & Q series - Phase X - Cur-
   Cur
\ \   stack.data " C1BnQ-CC.wks" \                    -Phase Optimize
\   stack.data " C-CC-BnQ.wks" \ Coh - Current Current - B and Q series
\   stack.load " C-CC-BnQ.bpf"                                         226
\ ;
\ " 08/21/98-17:02"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot
\                                                                      231
\ forget file.name
\ : file.name
\   stack.data " C-WC-BMC.wks" \ Coh - Wave Cur - B series - Modified
   Complex
\   stack.load " C-WC-B-M.bpf" \
\ ;                                                                    236
\ " 08/21/98-17:02"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot
\
\ forget file.name                                                     241
\ : file.name
\   stack.data " C-WC-1FC.wks"
\   stack.load " C-WC-1F.bpf"
\ ;
\ " 08/22/98-00:33"  set.new.d&t                                       246
\ cdt load FigAPlot.asy
\ \ mon.plot
\
\ forget file.name
\ : file.name                                                          251
\   stack.data " C-WC-2FC.wks"
\   stack.load " C-WC-2F.bpf"
\ ;
\ " 08/22/98-00:33"  set.new.d&t
\ cdt load FigAPlot.asy                                                256
\ \ mon.plot
\
\ forget file.name
\ : file.name
\     stack.data " C-WC-4FC.wks"                                       261
\     stack.load " C-WC-4F.bpf"
\ ;
\ " 08/22/98-00:33"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot                                                           266
```



```
\
\ forget file.name
\ : file.name
\   stack.data " C-WC-A-R.wks" \ Coh - Wave Cur - A series - Real
\   stack.load " C-WC-A.bpf"                                           271
\ ;
\ " 08/22/98-14:30"  set.new.d&t
\ cdt load FigAPlot.asy
\ \ mon.plot
\                                                                      276
\ \ ----------------------------------------------------------------
\ \ ================================================================
\ \ ----------------------------------------------------------------

: All.file.name                                                        281
  \  " n"       1x1y.flag  ":=
  \ ---------------------------------------
  \   wks.file.name      FB2.file.name
  \ ---------------------------------------
  " C-WC-BRC.wks"      " C-WC-B-M.bpf"                                 286
  " C-WCs-A.wks"       " C-WCs-A.bpf"
  " C-WCs-9F.wks"      " C-WCs-9F.bpf"
  " C-WCs-4F.wks"      " C-WCs-4F.bpf"
  " C-WCs-2F.wks"      " C-WCs-2F.bpf"
  " C-WCs-1F.wks"      " C-WCs-1F.bpf"                                 291
  " C-SC-.wks"         " C-SC-.FB2"
  " C-WC-BRC.wks"      " C-WC-B-M.bpf"
  " C-CC-BnQ.wks"      " C-CC-BnQ.bpf"
  " C-WC-BMC.wks"      " C-WC-B-M.bpf"
  " C-WC-B_C.wks"      " C-WC-B.FB2"                                   296
  " C-WC-B_R.wks"      " C-WC-B.FB2"
  " C-WC-1FC.wks"      " C-WC-1F.bpf"
  " C-WC-2FC.wks"      " C-WC-2F.bpf"
  " C-WC-4FC.wks"      " C-WC-4F.bpf"
  " C-WC-F4r.wks"      " C-WC4F.FB2"       \ use ymax=0.5              301
  " C-WC-A_C.wks"      " C-WC-A.FB2"
  " C-WC-A-R.wks"      " C-WC-A.bpf"
  " C-model.wks"       " C-WC-A.FB2"       \ use " C-WC-A-R.wks"
  " C-psi1or.wk1"      " C-psi1or.FB2"     \ Re & Im parts of wavelets
     bat1
  " C-psi2or.wk1"      " C-psi2or.FB2"     \ Re & Im parts of wavelets 306
     bat2
  " C-psi-ol.wk1"      " C-psi-ol.FB2"     \ Re & Im parts of wavelets
     bat3
  \ " MorletRI.wk1"      " C-psi-ol.FB2"   \ Re & Im parts of wavelets
  " C-WC-R1A.wks"      " C-WC-A.FB2"       \ sai=50~5.5  a series
  " C-WC-R0A.wks"      " C-WC-A.FB2"       \    =11~5.5  a
  " C-WC-R-A.wks"      " C-WC-A.FB2"                                   311
  \ " C-WC-C2p.wks"
  \ " C-WC-C.wks"
  \ " C-WC-R.wks"
;
\ ================================================================     316
```

Plt_WBP.shl

A01777-20161209-A031 ❖ December 9, 2016 ❖ [Page count: 3]

```
: Plt_TnD.shl ; \ Wavelet packet at different levels \ -*- txt:asy -*-
\ Wednesday, 2002/11/20 at 20:56:41
\ ------------------------------------------------------------------
\ ------------------------------------------------------------------
\ PhiPsi.str tmp.s ":="
fa
\ 4 string PhiPsi.str
\ tmp.s PhiPsi.str ":="
\ ------------------------------------------------------------------
4 string PhiPsi.str
: Choose.MW.FW
  cr
  ." Mother (psi) of Father (phi) wavelet"  " M" get.str
  " F" "=
  if
    " Phi-" PhiPsi.str ":=
  else
    " Psi-" PhiPsi.str ":=
  then
;
\ Choose.MW.FW
\ ------------------------------------------------------------------
cdt load FigA-Ini.asy \
1.5 ps.linewidth.now :=
\ ------------------------------------------------------------------
\ ------------------------------------------------------------------
5 string wlet
" on11c" wlet ":=
" on22a" wlet ":=
\ ------------------------------------------------------------------
1 string wp.or.wb.str
\ stack.data and stack.load are dummies for input gathering only
" P" wp.or.wb.str ":=
: file.name
  stack.data " WPon22A1.WKS"
  stack.load " WPon22A1.BPF"
  "drop "drop
  " W" wp.or.wb.str "cat wlet "cat " 1.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 1.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

: file.name
  stack.data " WPon22A2.WKS"
  stack.load " WPon22A2.BPF"
  "drop "drop
  " W" wp.or.wb.str "cat wlet "cat " 2.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 2.bpf" "cat
;
cdt load FigACore.asy \
forget file.name
```



```
: file.name
  stack.data " WPon22A3.WKS"
  stack.load " WPon22A3.BPF"
  "drop "drop
  " W" wp.or.wb.str "cat wlet "cat " 3.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 3.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

\ ------------------------------------------------------------------
" B" wp.or.wb.str ":=
: file.name
  " W" wp.or.wb.str "cat wlet "cat " 1.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 1.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

: file.name
  " W" wp.or.wb.str "cat wlet "cat " 2.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 2.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

: file.name
  " W" wp.or.wb.str "cat wlet "cat " 3.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 3.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

\ ------------------------------------------------------------------
" on22a" wlet ":=
" on11c" wlet ":=
\ ------------------------------------------------------------------
1 string wp.or.wb.str
\ stack.data and stack.load are dummies for input gathering only
" P" wp.or.wb.str ":=
: file.name
  " W" wp.or.wb.str "cat wlet "cat " 1.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 1.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

: file.name
  " W" wp.or.wb.str "cat wlet "cat " 2.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 2.bpf" "cat
;
cdt load FigACore.asy \
forget file.name
```

```
: file.name
  " W" wp.or.wb.str "cat wlet "cat " 3.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 3.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

\ ================================================================
" B" wp.or.wb.str ":=
: file.name
  " W" wp.or.wb.str "cat wlet "cat " 1.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 1.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

: file.name
  " W" wp.or.wb.str "cat wlet "cat " 2.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 2.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

: file.name
  " W" wp.or.wb.str "cat wlet "cat " 3.wks" "cat
  " W" wp.or.wb.str "cat wlet "cat " 3.bpf" "cat
;
cdt load FigACore.asy \
forget file.name

\ ================================================================
\
\ : file.name
\   stack.data " ■"
\   stack.load " ■.BPF"
\ ;
\ cdt load FigACore.asy \
\ forget file.name

\ ================================================================
```

PenPlot.asy

A01778-20161209-A032 ❖ December 9, 2016 ❖ [Page count: 15]

```
\ Asyst text file       ----------- WORDauto .PLO -----------        Lee     1
   Yueon-Ron
\ Note              :: 1. Words for pen plotter
\                      2. Any plotting size ( single or double ports )
\                      3. Any X- or Y- plotting scale ( enlagement or
   reduction )
\                      4. Both sofeware and hardwave scalings can be
   synthesized
\                      5. Optimised for pleasing authentic graphs           6
\                      6. Modified auto plot routines ( rotating and
   scaling )
\                      7. centered.label command will cause label shifting
\                      8. 05/01/91
\ ------------------------------------------------------------------
                                                                           11
echo.off

: xy.data.fit
  over  over
  []min/max   vertical      world.set                                      16
  []min/max   horizontal    world.set
;
: xyap.p
  \  vuport.clear   \  ---->  commented  for scaling up and down so that
  xy.data.fit       \         all parts can be drawn                       21
  xy.axis.plot
  xy.data.plot
;
: yap.p
  index.array                                                              26
  xyap.p
;

\ !0-------------------------------------------------------------------0!
                                                                           31
HP7470  \  -- ansi A        7475 -- ansi B

" vs9;"    graph.command   \  ceramic pen = 10  , ink pen = 20

real scalar  x.vup.o          scalar  y.vup.o                              36
     scalar  x.vup.s          scalar  y.vup.s
     scalar  x.pap.s          scalar  y.pap.s
     scalar  v.h.fla          scalar  tmp.v
     scalar  a4.sho           scalar  a4.lon
     scalar  x.axi.o          scalar  y.axi.o                              41
     scalar  x.axi.s          scalar  y.axi.s
     scalar  x.cha.s          scalar  y.cha.s
     scalar  x.lab.a          scalar  y.lab.a
     scalar  x.til.a          scalar  y.til.a
     scalar  x.cap.a          scalar  y.cap.a                              46
     scalar  sca.siz.x        scalar  ssx
     scalar  sca.siz.y        scalar  ssy
```



```
     scalar  r.p.len.x        scalar  r.p.len.y
     scalar  a.p.len.x        scalar  a.p.len.y
     scalar  r.p.l.sho        scalar  r.p.l.lon                            51
     scalar  def.r.p.l.sho    scalar  def.r.p.l.lon
     scalar  sof.sca.x        scalar  sof.sca.y
     scalar  r.p.sca.x        scalar  r.p.sca.y
     scalar  x.vup.o.sf       scalar  y.vup.o.sf
     scalar  sla.deg          scalar  #.por                                56

integer      scalar  v.h.fla  scalar  sca.u.d  scalar aut.plo.fla
             scalar  tmp.v.i  scalar  pen.1    scalar pen.2

80 string  case.name                                                       61

 plotter.defaults
 normal.coords

 0.      aut.plo.fla  :=   \  1-auto                                       66
 9       v.h.fla      :=   \  0-V    9-H
 19.05   a4.sho       :=
 25.65   a4.lon       :=
 0.15    x.axi.o      :=
 0.15    y.axi.o      :=                                                   71
 0.80    x.axi.s      :=
 0.80    y.axi.s      :=
 1.05    x.cap.a      :=   \ amplication factor for caption character
 1.10    y.cap.a      :=
 1.10    x.lab.a      :=   \ amplication factor for  label  character      76
 1.15    y.lab.a      :=
 1.15    x.til.a      :=   \ amplication factor for  label  character
 1.30    y.til.a      :=
 0.      sla.deg      :=
 1       pen.1        :=                                                   81
 2       pen.2        :=
 a4.sho  y.pap.s      :=
 a4.lon  x.pap.s      :=
 20.     def.r.p.l.lon  :=
 15.     def.r.p.l.sho  :=                                                86

: ol
  " vs9;"   graph.command    \ ceramic pen = 10  , ink pen = 20
  " sp"  pen.2 "."  "cat  " ;"  "cat            graph.command
  outline                                                                  91
  " sp"  pen.1 "."  "cat  " ;"  "cat            graph.command
\  " vs20;"  graph.command
  " vs5;"  graph.command
;
                                                                           96
: cha.siz   \  ssx and ssy   are used to incorperate hardware scaling
  normal.coords     color.on   3  foreground
  y.pap.s /  ssy *      swap   x.pap.s / ssx *              swap
     CHAR.SIZE
;
: label                                                                   101
  label  color.off
```

```
;
: abs.pos      \    no scaling  absolute position
  normal.coords
  y.pap.s / ssy / y.vup.s /      swap                                  106
  x.pap.s / ssx / x.vup.s /      swap    position
;

: std.v.lab.for
  x.cha.s     y.cha.s        cha.siz                                   111
  horizontal
  \             0            5               label.points
  \             \                            world.set
                0.90         0.065           label.scale.point
               -0.5 ssx /   -0.7 ssy /   5    label.format              116
  vertical
  \             0            5               label.points
  \             \                            world.set
                0.035        0.95            label.scale.point
               -1.2 ssx /   -0.0 ssy /   5    label.format              121
;
: std.h.lab.for
  x.cha.s       y.cha.s      cha.siz
  horizontal
  \             0            5               label.points              126
  \             \                            world.set
                0.90         0.075           label.scale.point
                -0.5 ssx /   -0.5 ssy /   5   label.format
  vertical
  \             0            5               label.points              131
  \             \                            world.set
                0.05         0.95            label.scale.point
               -1.2 ssx /    -0.0 ssy /   5   label.format
;                                                                      136
\
   !2^1----------------------------------------------------------------1^2!


: vpor.to.hpor
  0    v.h.fla       =
  if                                                                   141
     PLOT.ROTATE
     9.   v.h.fla   :=
  then
     a4.lon x.pap.s   :=
     a4.sho y.pap.s   :=                                               146
     r.p.len.x    x.pap.s /    r.p.sca.x   :=
     r.p.len.y    y.pap.s /    r.p.sca.y   :=
  normal.coords
;
: hpor.to.vpor                                                         151
  9    v.h.fla       =
  if
     PLOT.ROTATE
     0.   v.h.fla   :=
```



```
  then                                                                 156
     a4.sho x.pap.s   :=
     a4.lon y.pap.s   :=
     r.p.len.x    x.pap.s /    r.p.sca.x   :=
     r.p.len.y    y.pap.s /    r.p.sca.y   :=
  normal.coords                                                        161
;

: o.v.p.inf.con
  0.0                          x.vup.o.sf   :=
  0.0                          y.vup.o.sf   :=                         166
  0.20        sof.sca.x *      x.cha.s      :=
  0.40        sof.sca.y *      y.cha.s      :=
  hpor.to.vpor
;                                                                      171
: o.h.p.inf.con
  0.0                          x.vup.o.sf   :=
  0.0                          y.vup.o.sf   :=
  0.18        sof.sca.x *      x.cha.s      :=
  0.46        sof.sca.y *      y.cha.s      :=                         176
  vpor.to.hpor
;
: u.v.p.inf.con
  1.5                          x.vup.o.sf   :=
  2.5                          y.vup.o.sf   :=                         181
  0.15        sof.sca.x *      x.cha.s      :=
  0.30        sof.sca.y *      y.cha.s      :=
  hpor.to.vpor
;
: l.v.p.inf.con                                                        186
  1.5                          x.vup.o.sf   :=
  2.5                          y.vup.o.sf   :=
  0.15        sof.sca.x *      x.cha.s      :=
  0.30        sof.sca.y *      y.cha.s      :=
  hpor.to.vpor                                                         191
;
: u.h.p.inf.con
  2.5                          x.vup.o.sf   :=
  1.5                          y.vup.o.sf   :=
  0.15        sof.sca.x *      x.cha.s      :=                         196
  0.38        sof.sca.y *      y.cha.s      :=
  vpor.to.hpor
;
: l.h.p.inf.con
  2.5                          x.vup.o.sf   :=                         201
  1.5                          y.vup.o.sf   :=
  0.15        sof.sca.x *      x.cha.s      :=
  0.38        sof.sca.y *      y.cha.s      :=
  vpor.to.hpor
;                                                                      206

: p.inf.1
    v.h.fla   0   =
    if
```

```
      r.p.len.x   def.r.p.l.sho /     x.vup.o.sf *    x.vup.o.sf   :=          211
      r.p.len.y   def.r.p.l.lon /     y.vup.o.sf *    y.vup.o.sf   :=
    else
      r.p.len.x   def.r.p.l.lon /     x.vup.o.sf *    x.vup.o.sf   :=
      r.p.len.y   def.r.p.l.sho /     y.vup.o.sf *    y.vup.o.sf   :=
    then                                                                    216
;
\
   !3^2*************-------------------------------------------------*************


integer        scalar p1x    scalar p1y    scalar p2x    scalar p2y   \ a c b
    d
               scalar p3x    scalar p3y    scalar p4x    scalar p4y   \ p r q  221
                   s

: set.sca
  " IN;"   graph.command
  v.h.fla
  color.on    12    foreground                                              226
  nd
  cr ."
     ------------------------------------------------------------------------
     "
  cr ."   0 : Vertical            9 : Horizontal       \  {:set.sca;}
            "
  cr ."
     ------------------------------------------------------------------------
     "
  cr ."   Choose V or H :        " #input    v.h.fla   :=      10 inten        231
     foreground
           v.h.fla   <>     if   plot.rotate   then
  cr ."
     ************************************************************************
     "
  cr ."   1 : Default vuports     2 : Set scales     3: Set scale without
           "
  cr ."        ( 20 * 15 cm )          ( overall )        character scaling
          "
  cr ."                                                                      236
     ------------------------------------------------------------------------
     "
\ cr ."

    "
\ cr ."      ------ 25.7cm -----         --------------      --------------
        "
\ cr ."      |                  |        | Horizontal |      | Vertical    |
        "
\ cr ."      |  Original port 19.05cm    |      port    Y cm   |      port    X
     cm   "
\ cr ."      |                  |        |            |      |             |  241
        "
\ cr cr      P------------------         P-- X cm -----      P---- Y cm ---
        "
```



```
\ cr ."

    "
\ cr ."
    ------------------------------------------------------------------------
    "
  cr ."   Choose OPTION        : " #input    sca.u.d   :=        3
     foreground
  cr ."                                                                      246
     ------------------------------------------------------------------------
     "
  cr


1.           sof.sca.x   :=
1.           sof.sca.y   :=
                                                                             251
1  sca.u.d  =
if
  0  v.h.fla  =
  if
    def.r.p.l.sho           r.p.len.x     :=                                 256
    def.r.p.l.lon           r.p.len.y     :=
  else
    def.r.p.l.lon           r.p.len.x     :=
    def.r.p.l.sho           r.p.len.y     :=
  then                                                                       261
then

2  sca.u.d  =     3  sca.u.d  =   or
if
  cr ."     REFERENCE  port's      X-dir         length : " #input           266
     r.p.len.x   :=
  cr ."                            Y-dir         length : " #input
     r.p.len.y   :=
  cr ."          ------------------------------------------"
then

0  v.h.fla  =                                                               271
if
  r.p.len.x     r.p.l.sho     :=
  r.p.len.y     r.p.l.lon     :=
else
  r.p.len.x     r.p.l.lon     :=                                           276
  r.p.len.y     r.p.l.sho     :=
then

1    sca.u.d   =
if                                                                         281
      v.h.fla  0  =
      if     o.v.p.inf.con
      else   o.h.p.inf.con
      then
      r.p.sca.x             x.vup.o.sf  x.pap.s /  2. *  -  x.vup.s  :=    286
      r.p.sca.y             y.vup.o.sf  y.pap.s /  2. *  -  y.vup.s  :=
      r.p.len.x       x.pap.s /  x.vup.s /         ssx :=
```

```
      r.p.len.y        y.pap.s /   y.vup.s /         ssy :=
then
                                                                    291
2  sca.u.d  =    3 sca.u.d  =   or
if     14  foreground
  cr ."      1   port  or   2 ports  : " #input   #.por    :=
  1  #.por    =
  if                                                                296
    cr ."     set  O.H.P  or  O.V.P  ::     X_wnd_length = " #input
       a.p.len.x :=
    cr ."                                   Y_wnd_length = " #input
       a.p.len.y :=
    v.h.fla  0  =
    if     o.v.p.inf.con
    else   o.h.p.inf.con                                            301
    then
    p.inf.1
    r.p.sca.x             x.vup.o.sf   x.pap.s /  2. *  -  x.vup.s  :=
    r.p.sca.y             y.vup.o.sf   y.pap.s /  2. *  -  y.vup.s  :=
    a.p.len.x  x.pap.s /   x.vup.s /         ssx :=                 306
    a.p.len.y  y.pap.s /   y.vup.s /         ssy :=
  else
    cr ."     set  U.h.p  or  L.v.p  ::     X_wnd_length = " #input
       a.p.len.x :=
    cr ."                                   Y_wnd_length = " #input
       a.p.len.y :=
    v.h.fla  0  =                                                   311
    if     l.v.p.inf.con
    else   l.h.p.inf.con
    then
    p.inf.1
    r.p.sca.x               x.vup.o.sf   x.pap.s /  2. *  -  x.vup.s  :=   316
    r.p.sca.y    2. /       y.vup.o.sf   y.pap.s /        -  y.vup.s  :=
    a.p.len.x  x.pap.s /   x.vup.s /         ssx :=
    a.p.len.y  y.pap.s /   y.vup.s /         ssy :=
  then
then                                                                321
cr ."
   ------------------------------------------------------------------------
   "
cr cr  color.off

3  sca.u.d  =
if                                                                  326
  v.h.fla  0  =
  if      r.p.len.x     def.r.p.l.sho  /
          r.p.len.y     def.r.p.l.lon  /     swap
  else    r.p.len.x     def.r.p.l.lon  /
          r.p.len.y     def.r.p.l.sho  /     swap                   331
  then
  ssx   /      sof.sca.x  :=
  ssy   /      sof.sca.y  :=
then
                                                                    336
0  v.h.fla  =
```



```
if                        \  set to  ROLAND  system  ( Hardware )
  ssx             sca.siz.y  :=
  ssy             sca.siz.x  :=
else                                                                341
  ssx             sca.siz.x  :=
  ssy             sca.siz.y  :=
then

                          \       IP  :   a c b d                   346
                          \       SC  :   p q r s
                          \
                          \
                          \
                          \       ------------------------------------  (  351
    q,s )
                          \       |                                  4|
                          \       |   ---------------- ( b,d )       |
                          \       |   |              2|               |
                          \       |   |    IP         |               |
                          \       |   |1              |               |  356
                          \       |   ----------------                |
                          \       |   ( a,c )                         |
                          \       |                SC                 |
                          \       |3                                  |
                          \       ------------------------------------  361
                          \       ( p,r )
                          \       IP  :   a c b d
                          \       SC  :   p q r s       scale = IP / SC
                          \
11040     r.p.l.lon  400 *     -       2. /     p3x  :=    \ SC        366
11040     p3x -                                  p4x  :=
7721      r.p.l.sho  400 *     -       2. /     p3y  :=
7721      p3y -                                  p4y  :=

11040     p4x  p3x -    sca.siz.x * - 2. /     p1x  :=    \ IP        371
11040     p1x                         -        p2x  :=
7721      p4y  p3y -    sca.siz.y * - 2. /     p1y  :=
7721      p1y                         -        p2y  :=

  \  Shift SC to match SC port with IP port                          376
  \  The center of IP port locates at paper center
  \  ( without any scaling restriction )
  \  { 37.1 , 2.70 } based on reference port sizes of ( 20*15 )  and  (
     5*5 )
  p4x  p3x   2 *dup
    -   p2x  p1x -  40. / /  37.1  sca.siz.x *  4. /  * neg  p3x +     381
        p3x  :=
    -   p2x  p1x -  40. / /  37.1  sca.siz.x *  4. /  * neg  p4x +
        p4x  :=
  p4y  p3y   2 *dup
    -   p2y  p1y -  40. / /  2.70  sca.siz.y *  3. /  * neg  p3y +
        p3y  :=
    -   p2y  p1y -  40. / /  2.70  sca.siz.y *  3. /  * neg  p4y +
        p4y  :=
                                                                    386
```

```
;
set.sca

21  10  22  70  window   lower.inner.wnd
lower.inner.wnd  {border}                                                391

: scale.size
  " in;"                        graph.command
  " ip" p1x fix "." "cat   " ," "cat  p1y fix "." "cat   " ," "cat
        p2x fix "." "cat   " ," "cat  p2y fix "." "cat   " ;" "cat       396
           graph.command
  " sc" p3x fix "." "cat   " ," "cat  p4x fix "." "cat   " ," "cat
        p3y fix "." "cat   " ," "cat  p4y fix "." "cat   " ;" "cat
           graph.command
   cr  ."        IP      p1x = " p1x .   p2x .    p1y .   p2y .
   cr  ."        SC      p3x = " p3x .   p4x .    p3y .   p4y .
                                                                         401
\ \ Maximum scale up can be achieved by not shifting IP   ---> This part
    has
\ \  been updated by the above SC shifting method to eliminate scale
   restriction
\ 0  v.h.fla  =
\ if
\ " ip" p1x float  37.1 40. *  4. /  sca.siz.x * + 120 - fix "." "cat  "  406
    ," "cat
\       p1y float  2.7  40. *  3. /  sca.siz.y * +       fix "." "cat  "
    ;" "cat
\ else
\ " ip" p1x float  37.1 40. *  4. /  sca.siz.x * + 240 - fix "." "cat  "
    ," "cat
\       p1y float  2.7  40. *  3. /  sca.siz.y * + 560 - fix "." "cat  "
    ;" "cat
\ then                                                                   411
\ graph.command

\  Shift IP port to a pleasing position ( impose a little scaling
   restriction )
0  v.h.fla  =
if                                                                       416
  " ip" p1x                                        80 -     "." "cat  "
     ," "cat
       p1y                                         80 -     "." "cat  "
          ;" "cat
else
  " ip" p1x                                       200 -     "." "cat  "
     ," "cat
       p1y                                        560 -     "." "cat  "  421
          ;" "cat
then
graph.command
;
\
   !4^3***************-----------------------------------------**************

                                                                         426
```



```
: p.inf.2
  1.  r.p.sca.x -  2. /    x.vup.o.sf  x.pap.s /        +        x.vup.o
        :=
      r.p.sca.x            x.vup.o.sf  x.pap.s /        2. *  -  x.vup.s
         :=
  x.vup.o  y.vup.o   VUPORT.ORIG
  x.vup.s  y.vup.s   VUPORT.SIZE                                         431
  scale.size
;
: o.p.inf
  p.inf.1
  1.  r.p.sca.y -  2. /    y.vup.o.sf  y.pap.s /        +        y.vup.o  436
        :=
      r.p.sca.y            y.vup.o.sf  y.pap.s /        2. *  -  y.vup.s
         :=
  p.inf.2
;
: 2.p.inf.l
  p.inf.1                                                                441
  1.  r.p.sca.y -  2. /    y.vup.o.sf  y.pap.s /        +        y.vup.o
        :=
      r.p.sca.y    2. /    y.vup.o.sf  y.pap.s /             -   y.vup.s
         :=
  p.inf.2
;
: 2.p.inf.u                                                              446
  p.inf.1
       0.5                 y.vup.o.sf  y.pap.s /        +        y.vup.o
         :=
      r.p.sca.y    2. /    y.vup.o.sf  y.pap.s /             -   y.vup.s
         :=
  p.inf.2
;                                                                        451

\
   !5^4-------------------------------------------------------------------

: 0.v.p
  o.v.p.inf.con
  o.p.inf                                                                456
  std.v.lab.for
;
: 0.h.p
  o.h.p.inf.con
  o.p.inf                                                                461
  std.h.lab.for
;
: u.v.p
  u.v.p.inf.con
  2.p.inf.u                                                              466
  std.v.lab.for
;
: l.v.p
  l.v.p.inf.con
  2.p.inf.l                                                              471
```

```
  std.v.lab.for
;
: u.h.p
  u.h.p.inf.con
  2.p.inf.u                                                          476
  std.h.lab.for
;
: l.h.p
  l.h.p.inf.con
  2.p.inf.l                                                          481
  std.h.lab.for
;
: 1.p
  x.vup.o  x.vup.s  0.1 *   +   x.vup.o  :=
  y.vup.o  y.vup.s  0.1 *   +   y.vup.o  :=                          486
  x.vup.s  0.8 *                x.vup.s  :=
  y.vup.s  0.8 *                y.vup.s  :=
  x.vup.o  y.vup.o   VUPORT.ORIG
  x.vup.s  y.vup.s   VUPORT.SIZE
  scale.size                                                         491
;
: v.p
  o.v.p   1.p
;
: h.p                                                                496
  o.h.p   1.p
;
\
   !6^5-------------------------------------------------------------------------


real        scalar  tmp.v.1          scalar tmp.v.2                  501

: all.cap          \  [ " CAP",  shift,  position -  ]
  sla.deg  slant
  dup  1  =
          if    v.h.fla 0 =    if u.v.p   else u.h.p    then          506
          cr  ." CAPTION for UPPER port is : "  "dup  "type    cr
          then
  dup  2  =
          if    v.h.fla 0 =    if l.v.p   else l.h.p    then
          cr  ." CAPTION for LOWER port is : "  "dup  "type    cr     511
          then
       3  =
          if    v.h.fla 0 =    if   v.p   else   h.p    then
          cr  ." CAPTION for V / H port is : "  "dup  "type    cr
          then                                                       516
  x.vup.o  x.vup.s  2. /  +    x.pap.s    *      tmp.v.1  :=
  y.vup.o  y.pap.s *                      +      tmp.v.2  :=
  \                    ? = -0.5
  v.h.fla  0  =
  if     o.v.p                                                       521
  else   o.h.p
  then
  tmp.v.1   x.vup.o  x.pap.s *  -      x.pap.s /  x.vup.s /   tmp.v.1
```



```
     :=
  tmp.v.2   y.vup.o  y.pap.s *  -      y.pap.s /  y.vup.s /   tmp.v.2
     :=
  "dup "len  2. /  x.cha.s *  x.cap.a *  x.pap.s /  x.vup.s /      tmp.v  526
     :=
  tmp.v.1  tmp.v -    tmp.v.1  :=
  tmp.v.1   tmp.v.2                      position
  x.cha.s  x.cap.a *    y.cha.s y.cap.a *   cha.siz
  label
  x.cha.s               y.cha.s             cha.siz                  531
;
: u.cap
  -0.5   1  all.cap
;
: l.cap                                                              536
  -0.5   2  all.cap
;
: 1.cap
  -0.6   3  all.cap
;                                                                    541
\
   !7^6-------------------------------------------------------------------------


: x.lab          \  [ x.lab -  ]
  scale.size
  "dup                                                               546
  sla.deg  slant
  x.cha.s  x.lab.a *    y.cha.s y.lab.a        *  cha.siz
  x.axi.o    x.axi.s 2. /  +      y.axi.o  0.360 *     position
  "dup "len  2. /  x.cha.s *  x.lab.a *  x.pap.s /  x.vup.s /      tmp.v
     :=
  x.axi.o    x.axi.s 2. /  +  tmp.v -    y.axi.o  0.360 *     position  551
  cr  ." Input LABEL for X axis : "  "type   cr
  \  centered.label  \   causing shift of axis label
  label
  0. label.dir
  x.cha.s               y.cha.s             cha.siz                  556
;
: y.lab          \  [ y.lab -  ]
  scale.size
  "dup
  sla.deg  slant                                                     561
  x.cha.s  x.lab.a *    y.cha.s y.lab.a  *   cha.siz
  x.axi.o  .300 *       y.axi.o  y.axi.s  2. /  +     position
  cr  ." Input LABEL for Y axis : "  "type    cr
  "dup "len  2. /  x.cha.s *  x.lab.a *  y.pap.s /  y.vup.s /
  ssx *   ssy /         tmp.v  :=   \  the scales in x and y dir are      566
     different
  x.axi.o  .360 *       y.axi.o  y.axi.s 2. /  +  tmp.v -   position
  90. label.dir
  label
  0. label.dir
  x.cha.s               y.cha.s             cha.siz                  571
;
```

```
: Lab.l
  0.        slant
  normal.coords                                                    576
  0.4   0.3       abs.pos
  0.14  0.18      cha.siz
  " Lee Y.R."     label
  x.cha.s                 y.cha.s              cha.siz
;                                                                  581
: Lab.d
  0.        slant
  normal.coords
  0.4   0.3       abs.pos
  0.14  0.18      cha.siz                                          586
  "date           label
  x.cha.s                 y.cha.s              cha.siz
;
: Lab.l.d
  0.  slant                                                        591
  normal.coords
  0.4   0.3       abs.pos
  0.14  0.18      cha.siz
  " Lee Y.R. "  "date   "cat         label
  x.cha.s                 y.cha.s              cha.siz             596
;

\ 40 string  data.filename.hp

: set.c.n         \  interactive   [  -  case.name ]                601
  cr cr
  ." Style of label ::              "          cr
  ."                    (1) CASE :    "          cr
  ."                    (2) other     "          cr
  ." Choose 1 or 2  :   "  #input cr                               606
  1  =
  if
     " CASE : "  cr  inv.on
    ." CASE : "      inv.of         "input   "cat   case.name    ":=
  else             cr  inv.on                                     611
    ." Any label content :" inv.of "input         case.name    ":=
  then  cr
  case.name
;                                                                  616
: lab.c          \  [ case.name  -  ]
  scale.size
  "dup  case.name  ":=
  "dup  cr cr                                          color.on  4
     foreground
  inv.on     ." Title is : " inv.of       "TYPE CR       color.off  621
  aut.plo.fla    0  =
  if
    inv.on     ." Is it OK ! " inv.of      ." to exit press <F>"
    pckey  drop  if  set.c.n  then
  then                                                             626
```



```
  sla.deg  slant
  normal.coords
  \ data.filename.hp   case.name   ":=
  \ " CASE : "  case.name   "cat   "dup  "len   tmp.v  :=
                                              "len   tmp.v  :=     631
  x.vup.s x.pap.s *     dup  x.cha.s  x.til.a *  tmp.v *    -    swap
     /
  y.axi.o y.axi.s +                                    position
  x.cha.s  x.til.a *    y.cha.s y.til.a *          cha.siz
  label
  x.cha.s       y.cha.s     cha.siz                                636
;
\
   !8^7-------------------------------------------------------------------


real scalar x.pos             scalar y.pos
     scalar x.c.siz           scalar y.c.siz                       641

x.cha.s     x.c.siz   :=
y.cha.s     y.c.siz   :=

: LAB           \  interactive                                     646
  scale.size
  sla.deg  slant
  normal.coords
  cr  cr
  ." POSITION within port (abs in cm) : {;pos:}"                   651
  ." X.p = " x.pos  .     ."    Y.p = " y.pos   .  x.pos   y.pos
     abs.pos   CR
  ." CHAR.SIZE            (abs in cm) : {;cha:}"
  ." X.s = " x.c.siz .    ."    Y.s = " y.c.siz .  x.c.siz y.c.siz
     cha.siz cr cr
  ." LABEL     : "           "input  LABEL
;                                                                  656
: pos
  cr ." Input absolute position    ( X.p  ,  Y.p )   ::  " cr ."     "
 ." X.p = " #INPUT  x.pos :=       ."    Y.p = " #INPUT y.pos :=     cr
  x.pos   y.pos   abs.pos   CR
;                                                                  661
: cha
  cr ." Input CHAR.SIZE           ( X.s  ,  Y.s )   ::  " cr ."     "
  ." X.s = " #INPUT  x.c.siz :=     ."    Y.s = " #INPUT y.c.siz :=   cr
  x.c.siz y.c.siz cha.siz   cr
;                                                                  666

\
   !9^8-------------------------------------------------------------------


: tom
  o.h.p                                                            671
  ibm.graphics
  device.init
;
```

```
: change.paper                                                          676
  cr   cr

      b.t
  cr   ." ***********  PLEASE CHANGE PAPER and PRESS ANY KEY ***********
      "  b.t
  BELL.LEE.3
  KEY DROP

      inv.on
  cr   ." ---------- Be sure to change paper AND Press any key ---------- 681
      " inv.of
  cr
  BELL.LEE.3
  KEY DROP
;
                                                                        686
nd integer scalar partial.clear

\
    ^9-------------------------------------------------------------------------


.....................................................................................................
```

FigA-Ini.asy

A01779-20161209-A033 ❖ December 9, 2016 ❖ [Page count: 2]

```
\  -*- txt:asy -*-  Wednesday, 02/11/20 at 20:52:00                    1
\  The same as FigAPlot.sel (shl)
\ ================================================================
1  string output.flag.str
26 string d&t.string
14 string new.d&t.string                                               6

integer scalar new.d&t.flag
real  scalar ps.linewidth.now
      scalar ps.linewidth.def
1.0            ps.linewidth.def       :=                               11
1.0            ps.linewidth.now       :=

0  new.d&t.flag  :=

: set.new.d&t                                                          16
  new.d&t.flag 1 =
  if
    new.d&t.string    ":=
  else
    "drop                                                              21
  then
;

: set.lc  \  [ line.colors.flag - ]
  lc.flag :=                                                           26
  lc.flag 0  =
  if
    0   lc1 :=
    lc1 lc2 :=  lc1 lc3 :=  lc1 lc4 :=  lc1 lc5 :=  lc1 lc6 :=
  else                                                                 31
    \  select.color
\       0 lc1 :=  9 lc2 := 12 lc3 := 13 lc4 := 11 lc5 := 10 lc6 := 0 lc7
   :=
\       0 lc1 :=  1 lc2 :=  4 lc3 :=  5 lc4 :=  6 lc5 :=  3 lc6 := 0 lc7
   :=
     0 lc1 :=  9 lc2 := 12 lc3 :=  5 lc4 :=  6 lc5 :=  3 lc6 := 0 lc7 :=
     \   9 lc1 :=   12 lc2 :=   10 lc3 :=                              36
     \  13 lc4 :=    0 lc5 :=   11 lc6 :=    0 lc7 :=
     \ 0 lc.flag :=
  then
;
: Choose.output                                                        41
  cr ." Chose output format:"
  cr ."                       M: Monitor"
  cr ."                       E: EPS"
  cr ."                       " " M" get.str
\   "dup s.type                                                        46
  output.flag.str ":=
  cr ." Chose Color or Black:"
  cr ."                       C: Color"
  cr ."                       B: Black"
```



```
  cr ."                       " " C" get.str                           51
  "dup
  "upper " C" "=
  if
    1 set.lc
  else                                                                 56
    0 set.lc
  then
;
Choose.output
```

FigAPlot.shl

A01780-20161209-A034 ❖ December 9, 2016 ❖ [Page count: 2]

```
\ ================================================================
1  string output.flag.str
26 string d&t.string
14 string new.d&t.string

integer scalar new.d&t.flag

0  new.d&t.flag  :=

: set.new.d&t
  new.d&t.flag 1 =
  if
    new.d&t.string    ":=
  else
    "drop
  then
;

: set.lc  \  [ line.colors.flag - ]
  lc.flag :=
  lc.flag 0  =
  if
    0   lc1 :=
    lc1 lc2 :=  lc1 lc3 :=  lc1 lc4 :=  lc1 lc5 :=  lc1 lc6 :=
  else
    \  select.color
\       0 lc1 :=  9 lc2 := 12 lc3 := 13 lc4 := 11 lc5 := 10 lc6 := 0 lc7
   :=
\       0 lc1 :=  1 lc2 :=  4 lc3 :=  5 lc4 :=  6 lc5 :=  3 lc6 := 0 lc7
   :=
     0 lc1 :=  9 lc2 := 12 lc3 :=  5 lc4 :=  6 lc5 :=  3 lc6 := 0 lc7 :=
    \   9 lc1 :=   12 lc2 :=   10 lc3 :=
    \  13 lc4 :=    0 lc5 :=   11 lc6 :=    0 lc7 :=
    \ 0 lc.flag :=
  then
;
: Chose.output
  cr ." Chose output format:"
  cr ."                      M: Monitor"
  cr ."                      E: EPS"
  cr ."                      " " M" get.str
\   "dup s.type
  output.flag.str ":=
  cr ." Chose Color or Black:"
  cr ."                      C: Color"
  cr ."                      B: Black"
  cr ."                      " " C" get.str
  "dup
  "upper " C" "=
  if
    1 set.lc
  else
```



```
    0 set.lc
  then
;
Chose.output
```

FigAPlot.asy

A01781-20161209-A035 ❖ December 9, 2016 ❖ [Page count: 15]

```
: FigAPlot.asy ; \ %----- Asyst Prog                                          1

\ %=================================================================
\ For plotting psi curves
\
\ load Llet-0.asy                                                          6
\ load Llet-cwt.asy
\ set.123
\    wks file
\ set.act
\    5                                                                    11
\    1024
\    start frequency:  0.6
\    # of frequency:1
\ load psiCwks.asy (uses wks file)
\                                                                         16
\ %-----------------------------------------------------------------
\ load this file: psiCplot.asy (need figaplot.asy)
\
\ (Equivalently --
\ load fig-plot.asy                                                       21
\      and input psiCfb1.fb1 (needs PsiC.bpf)
\ )
\ %=================================================================

\ ----------------------------------------------------------------       26
\ for auto batch plot of figures
\ %% set line colors & eps/mon in this file  (1 set.lc;  set.eps)
\ %% need          fixed   FigAFB-W.fb
\ %%        interactive  (FigABP.bpf)
\ ^----------------------------------------------------------------       31
\ %% Main code for Plotting figures using Asyst data or WKS data
\ %%  1.  Assign WKS file  and  FB2 file to be used
\ %%         Modify and Copy  ?.fb  to, such as,  WKS-FB-1.FB1
\ %%         ^^ (assign wks file to be used)
\ %%         Create xy-pairs batch file, such as, WKS-FB-2.FB2             36
\ %%         ^^ (assign FB2 file to be used)
\ %%         (design plot style, such as axis, grids, lgns, labels and
   strings)
\ %%  2.  load this file, which will execute do.plot or do.plot.wks
\ %%  3.  Use either
\ %%         do.plot    <-- Hil-edge.FB, etc (For fig file and render      41
   plot)
\ %%                    <-- WKS-FB-1.FB1, etc (for loading wks file)
\ %%         do.plot.wks <-- WKS-FB-2.FB2 (loading xy pairs and render
   plots)
\ ^----------------------------------------------------------------

\ %% String assignment                                                     46
\     0.  misce.str -- at Top Left, can be assigned in FB(2)
\     1.  spe.str.1 -- provided by wks file (element at row 1 column
   last)
```



```
\     2.  spe.str.2 or spe.str.3 -- (CASE) above Legend, use
   spe.str.2.or.3
\           spe.str.2: can be assigned in FB(2)
\           spe.str.3: default to eps.file.name, not changeable, see      51
   plot.bat
\     3   123.str.ary or lgn.str.ary -- Legends for lines, use
   get.lgns.a.or.d
\           123.str.ary: provided by wks file (first row)
\           lgn.str.ary: can be assigned in FB2
\ \\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\ dir.lee.txt  " def-anan.nam"  "cat defer> load                           56

\ cdtNow
\ load WD.asy
\ cdt
\ \ load def-anan.nam                                                     61
\ dir.lee.txt " def-anan.nam" "cat defer> load
cdt load def-anan.nam \

12  string   eps.file.name
12  string   FB2.file.name                                                66
64  string   Strange.str \ It is very strange!!! Needed for EPS.
64  string   spe.str.1   \ Loaded from wks file
\ 40  string   spe.str.1   \ Loaded from wks file
24  string   spe.str.2   \ assignable
24  string   spe.str.3   \ Default to eps.file.name                       71
1   string   get.lgns.a.or.d
1   string   non.stop.flag
1   string   put.abc.str
26  string   pre.abc.str
26  string   post.abc.str                                                 76
1   string   1x1y.flag
4   string   axis.fit.flag  \ " x0y1"
integer      scalar  put.abc.flag
             scalar  put.pre.abc.flag
             scalar  put.post.abc.flag                                    81
             scalar  put.d&t.flag
             scalar  put.spe.flag
             scalar  put.lgn.flag
             scalar  plot.#
             scalar  acc.plot.#  \  accumulated                           86
             scalar  eps.file.010203.flag
             scalar  spe.str.2.or.3
             scalar  x.lp.pos
             scalar  x.lp.inc
             scalar  y.lp.pos                                             91
             scalar  y.lp.inc
             scalar  font.size.xy.label
             scalar  font.size.ll
20  string   pair.name
Dim[ 6 , 20 ] string.array  pair.name.ary                                 96
Dim[ 6 , 20 ] string.array  lgn.str.ary
integer      scalar line.#.tmp
```

```
             scalar #.line.@
real scalar x.min.w
     scalar x.max.w                                                    101
     scalar y.min.w
     scalar y.max.w

\
   ------------------------------------------------------------------------

" d"            get.lgns.a.or.d        ":=                             106
" Times-Roman" font.type.n            ":=
20              font.size.xy.label      :=
20              font.size.ll            :=
18              font.size.l             :=
16              font.size.n             :=                              111
14              font.size.s             :=
0               x.lp.pos                :=
2               x.lp.inc                :=
0               y.lp.pos                :=
2               y.lp.inc                :=                              116
\
   ------------------------------------------------------------------------

integer scalar          #.line
integer dim[ 12 ] array line.#
integer scalar #.pts
\          scalar new.d&t.flag \ Moved to shell for auto plotling       121
real    scalar x.max

: change.d&t
  new.d&t.flag  1 =
  if                                                                    126
    new.d&t.string  d&t.string  ":=
  else
    "date   " -"  "cat   "time  "cat   d&t.string  ":=
  then
;                                                                       131
\ change.d&t
\    new.d&t.string  d&t.string  ":=
: labxy.xy
  x.label  y.label
  eps.flag 1 =                                                          136
  if   0.04
  else 0.02
  then
  eps.flag 1 =
  if                                                                    141
    font.type.n  font.size.xy.label  ps.font
    labxy.stack
    font.type.n  font.size.n         ps.font
  else
    labxy.stack                                                         146
  then
;
: put.d&t
```



```
  put.d&t.flag  1  =
  if                                                                    151
  normal.coords
  0.80  0.97 position  d&t.string  label
  world.coords
  then
;                                                                       156
: put.abc.part
  put.pre.abc.flag 1 =
  if
    pre.abc.str
  else                                                                  161
    "null
  then
  put.abc.flag  1  =
  if
    " ("  put.abc.str  "cat   " )" "cat                                 166
  else
    "null
  then
  put.post.abc.flag 1 =
  if                                                                    171
    post.abc.str
  else
    "null
  then
  "cat  "cat                                                            176
;
: put.abc.part.res
  put.abc.flag  1  =
  \ eps.flag      1  =  and
  if                                                                    181
    pre.abc.str
    " ("  "cat    put.abc.str  "cat   " )" "cat
  else
    pre.abc.str
  then                                                                  186
;
: put.abc
  normal.coords
  put.abc.part
  Strange.str  ":=  \ It is very strange!!! Needed for EPS.             191
  Strange.str       \ It is very strange!!! Needed for EPS. Otherwise,
    No print
  0.20  0.89    position      label
  world.coords
;                                                                       196

: put.spe
  put.spe.flag  1  =
  if
  normal.coords
  spe.str.2.or.3  3 =                                                   201
  if
    spe.str.3
```

```
  else
    spe.str.2
  then                                                              206

  misce.str  \  spe.str.1 at top left
  2.wnd.flag  1 =   \ assigned by hp.new, dp.new, dp.new
  if
    0.15  0.97    position            label                       211
    0.17
    eps.flag 1 =
    if     0.88
    else   0.91
    then          position            label                       216
  else
    0.15  0.97    position            label
    \ \    0.17  0.93    position            label
    2.wnd.flag  1 =   \ assigned by hp.new, dp.new, dp.new
    if                                                            221
      0.17  0.93    position            label
    else
      0.70  0.89    position            label
    then
 then                                                             226
 world.coords
 then
;
: put.lgn  \ [ line.#, line.posi, "text"  -- ]
  put.lgn.flag  1  =                                              231
  if
  normal.coords
  2.wnd.flag  1 =   \ assigned by hp.new, dp.new, dp.new
  if
    0.70                                                          236
    eps.flag 1 =
    if     0.88
    else   0.91
    then
  else                                                            241
    0.70   0.85
  then
  \ \   0.70  0.92
  key.orig
      mkl.bat                                                     246
      key.done
      world.coords
  then
;
\ ********************                                           251
: set.eps
  1  eps.flag :=
  " n"  my.pause.flag ":="
  \ 0  lc.flag :=
  \ 0  2in1.flag :=                                               256
;
: set.mon
```



```
  0  eps.flag :=
  \ 1  lc.flag :=
  \ 1  2in1.flag :=                                               261
;
: put.grid.lines   \  equivalent to xy.axis.plot
  grid.flag 1 =
  if
    0.5  ps.linewidth                                             266
    vertical
      grid.on
      no.labels
    horizontal
      grid.on                                                     271
      no.labels
    xy.axis.plot
  then
  1.0  ps.linewidth
  vertical                                                        276
    grid.off
    \     0  2  label.points
    x.lp.pos  x.lp.inc     label.points
  horizontal
    grid.off                                                      281
    \     0  2  label.points
    y.lp.pos  y.lp.inc     label.points
  \  xy.axis.plot
;
\ ********************                                          286
\ : set.lc  \  [ line.colors.flag - ]
\   lc.flag :=
\   lc.flag 0  =
\   if
\     0   lc1 :=                                                291
\     lc1 lc2 :=  lc1 lc3 :=  lc1 lc4 :=  lc1 lc5 :=  lc1 lc6 :=
\   else
\     \  select.color
\     0  lc1 :=    9 lc2 :=   12 lc3 :=
\     13 lc4 :=   11 lc5 :=   10 lc6 :=    0 lc7 :=               296
\     \   9 lc1 :=   12 lc2 :=   10 lc3 :=
\     \  13 lc4 :=    0 lc5 :=   11 lc6 :=    0 lc7 :=
\     \ 0 lc.flag :=
\   then
\ ;                                                             301
\ 1 set.lc
\
   ------------------------------------------------------------------------

\ ---------------------------------------- PS Words
   --------------------------
\ vuport ps.hp.port
\    .90  .90 vuport.size                                       306
\    .05  .05 vuport.orig
\ vuport ps.up.port
\    .90  .42 vuport.size
\    .05  .51 vuport.orig
```

```
\ vuport ps.dp.port                                                    311
\     .90  .42 vuport.size
\     .05  .07 vuport.orig
vuport ps.hp.port
    .900  .900 vuport.size
    .050  .050 vuport.orig                                             316
vuport ps.up.port
    .900  .440 vuport.size
    .050  .510 vuport.orig
vuport ps.dp.port
    .900  .440 vuport.size                                             321
    .050  .050 vuport.orig
\ vuport  h.port  0.0000 0.1500 vuport.orig  1.0000 0.8500 vuport.size
    outline
: ps.hp
        ps.hp.port
        horizontal  normal.coords  0.85  0.10  label.scale.point       326
            world.coords
\                                  0     2     label.points
                                   x.lp.pos  x.lp.inc     label.points
        vertical    normal.coords  0.07  0.87  label.scale.point
            world.coords
\                                  0     2     label.points
                                   y.lp.pos  y.lp.inc     label.points  331
        ps.graphics ;
: ps.up
        ps.up.port
        horizontal  normal.coords  0.85  0.10  label.scale.point
            world.coords
\                                  0     2     label.points          336
                                   x.lp.pos  x.lp.inc     label.points
        vertical    normal.coords  0.07  0.87  label.scale.point
            world.coords
\                                  0     2     label.points
                                   y.lp.pos  y.lp.inc     label.points
        ps.graphics ;                                                  341
: ps.dp
        ps.dp.port
        horizontal  normal.coords  0.85  0.10  label.scale.point
            world.coords
\                                  0     2     label.points
                                   x.lp.pos  x.lp.inc     label.points  346
        vertical    normal.coords  0.07  0.87  label.scale.point
            world.coords
\                                  0     2     label.points
                                   y.lp.pos  y.lp.inc     label.points
        ps.graphics ;
: port.axis.1.m                                                        351
            horizontal  normal.coords  0.85  0.10  label.scale.point
                world.coords
                                   x.lp.pos  x.lp.inc     label.points
\                                     0     2     label.points
            vertical    normal.coords  0.07  0.87  label.scale.point
                world.coords
                                   y.lp.pos  y.lp.inc     label.points ;  356
```



```
\                                     0     2     label.points ;
: port.axis.2.m
            horizontal  normal.coords  0.85  0.10  label.scale.point
                world.coords
                                   x.lp.pos  x.lp.inc     label.points
\                                     0     2     label.points          361
            vertical    normal.coords  0.04  0.87  label.scale.point
                world.coords
                                   y.lp.pos  y.lp.inc     label.points ;
\                                     0     2     label.points ;
: hp.tmp  h.port  {b.text}  t1.color tmp.c :=  port.axis.1.m  0.02
    y.lab.pos :=
            port.color     0  2.wnd.flag := ;                          366
: vp.tmp  v.port  {b.text}  t2.color tmp.c :=  port.axis.2.m  0.02
    y.lab.pos :=
            port.color     0  2.wnd.flag := ;
: lp.tmp  l.port  {l.text}  t1.color tmp.c :=  port.axis.2.m  0.95
    y.lab.pos :=
            port.color     1  2.wnd.flag := ;
: rp.tmp  r.port  {r.text}  t2.color tmp.c :=  port.axis.2.m  0.95      371
    y.lab.pos :=
            port.color           1  2.wnd.flag := ;
: up.tmp  u.port  {l.text}  t1.color tmp.c :=  port.axis.1.m  0.02
    y.lab.pos :=
            port.color     1  2.wnd.flag := ;
: dp.tmp  d.port  {r.text}  t2.color tmp.c :=  port.axis.1.m  0.02
    y.lab.pos :=
            port.color     1  2.wnd.flag := ;                          376
: fp.tmp  f.port  {f.text}  t1.color tmp.c :=  port.axis.1.m  0.02
    y.lab.pos :=
            port.color     0  2.wnd.flag := ;
: hp.res  hp ;
: up.res  up ;
: dp.res  dp ;                                                         381
: hp.new
  eps.flag 1 =
  if        ps.hp  0 2.wnd.flag :=
  else      hp.tmp
  then                                                                 386
\  outline.color color solid  outline
;
: up.new
  eps.flag 1 =
  if        ps.up  1 2.wnd.flag :=                                     391
  else      up.tmp
  then
\  outline.color color solid  outline
;
: dp.new                                                               396
  eps.flag 1 =
  if        ps.dp  1 2.wnd.flag :=
  else      dp.tmp
  then
\  outline.color color solid  outline                                  401
;
```

```
: hint.tmp
  cr  ." Command:"
\  " 1 set.lc; set.mon; set.eps -> do.plot"  s.type.3
\  " (.wks)" s.type ."  "  " (wks.bat)"  s.type                    406
  " 1 set.lc; set.mon; set.eps -> do.plot"  s.type.3
  ."  "  " [fig.FB]"  s.type
  cr  ." Command:"
  " 1 set.lc; set.mon; set.eps -> do.plot.wks"  s.type.3
  ."  "  " [?.bpf]"  s.type                                        411
;
\
   ------------------------------------------------------------------------------


\ def.vuport
\                                                                  416
   ------------------------------------------------------------------------------

\ ---------------------------------------- Pre Part
   ---------------------------
: ini.gr.out
  eps.flag 1 =
  if    sd
  \  else  sd                                                      421
  else  gd
  then
  def.vuport
  \  ps.graphics
  11 8.5 ps.paper.size                                            426
  ps.encapsulate
  ps.landscape
  eps.flag 1 =
  if
    vertical                                                      431
      grid.off
      \ no.labels
    horizontal
      grid.off
      \ no.labels                                                 436
    \ ---------------
    \    cr cr  ." ---> EPS file: "
\    cr cr  ." ---> EPS file ["  2 1 fix.format  Plot.# 0 n>s s.type.3
   ." ]: "
    cr cr  ." ---> EPS file ["
    put.abc.part  s.type.3  ." /"                                 441
    2 1 fix.format  acc.plot.# 0 n>s s.type.3  ." ]: "
    cdf.now.str
    eps.file.010203.flag  1 =
    if
      acc.plot.#    9  <=                                         446
      if
        " 0"
      else
      then
      acc.plot.#    0 n>s  "cat                                   451
```



```
      " .eps"              "cat
      eps.file.name  ":=
    then
    eps.file.name
    non.stop.flag "upper  " Y"  "=                                456
    if
      "cat
    else
      get.str   "dup   eps.file.name  ":=    "cat
    then                                                          461
    \    ." ---> EPS file: "  " 01.eps"  get.str     "cat
    "dup   s.type.3
    defer> ps.file
    ps.graphics
    ps.start                                                      466
    font.type.n  font.size.n  ps.font
    1.0 ps.linewidth
    ps.hp  ps.up  ps.dp
    \ initializing
  then                                                            471
;
\ ---------------------------------------- End Part
   ---------------------------
: end.gr.out
  normal.coords
  1  1  position                                                 476
  world.coords
  eps.flag 1 =
  if
    ps.end
    def.vuport                                                    481
    ibm.graphics
    \ gd
  else
  then
  eps.flag   0   =                                                486
  if
    my.pause
  else
    sd
    cr cr  ." ---> EPS file ["                                    491
    put.abc.part  s.type.3  ." /"
    2 1 fix.format  acc.plot.# 0 n>s s.type.3  ." ]: "
    cdf.now.str     eps.file.name      "cat      s.type.3   ."  "
    " All done!" s.type.2
  then                                                            496
  hint.tmp
;
: for.mon.gd
  eps.flag 1  = not
  if                                                              501
    gd
  then
;
\
```

```
    !*************************************************************************

: do.plot                                                                  506
  plot.#  1  +   plot.#  :=
  acc.plot.# 1 +  acc.plot.# :=
  \
  \ sd  \ \% for debugging
                                                                           511
  hint.tmp
  cr  ." Figure body file : "
  \ cr  ."  (Gen:Acc3w1i0.FB, WKS:WKS-1xAy.fb, etc.) "  " C-WC-R_F.FB"
     get.str
  cr  ."  (Gen:Acc3w1i0.FB, WKS:WKS-1xAy.FB, etc.) "
  \  " WKS-FB-1.FB1"  get.str                                             516
  \  " WKS-FB-1.FB3"  get.str
  \  " WKSaFB-1.FB1"   \   get.str  \ \ FOR AUTO BATCH PLOT
  " FigAFB-W.fb" \ stack.load \ " FigAFB-W.fb" \ get.str \ FOR AUTO
     BATCH PLOT
  \
     ------------------------------------------------------------------------

  ini.gr.out                                                               521
  \ ---------------------------------- Begin Body of graph
     --------------------
  \ dir.lee.txt  "swap   "cat defer> load
  cdt.now.str "swap "cat defer> load
  \
  \ ---------------------------------- End   Body of graph                 526
     --------------------
  end.gr.out
  \
     ------------------------------------------------------------------------

;
\ " WKS-FB-2.FB2"  FB2.file.name  ":=
stack.load " FigABP.bpf"                                                   531
FB2.file.name  ":=
\ : do.plot.wks
\   \
   ------------------------------------------------------------------------

\   \ cr  ." WKS Plot Batch file : (C-WC_B.Bat, etc.) "  " C-WC_B.Bat"
   get.str
\   cr  ." WKS Plot Batch file : (WKS-FB-2.FB2, etc.) "                    536
\ \  FB2.file.name  get.str  \ \ FOR INTERACTIVE PLOT
\   FB2.file.name  \  get.str  \ \ FOR AUTO BATCH PLOT
\ \   dir.lee.txt  "swap   "cat defer> load
\   cdt.now.str  "swap   "cat defer> load
\   \                                                                      541
\   \
   ------------------------------------------------------------------------

\ ;
: do.plot.wks
  \
```



```
     ------------------------------------------------------------------------

  \ cr  ." WKS Plot Batch file : (C-WC_B.Bat, etc.) "  " C-WC_B.Bat"      546
     get.str
  cr  ." WKS Plot Batch file : (WKS-FB-2.FB2, etc.) "
  \  FB2.file.name  get.str  \ \ FOR INTERACTIVE PLOT
  FB2.file.name  \  get.str  \ \ FOR AUTO BATCH PLOT
  cdt.now.str "swap "cat defer> load
  \                                                                        551
  \
     ------------------------------------------------------------------------

;
\ \\
   ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

\
   ^*************************************************************************

                                                                           556
cdt
load 123-A2W.asy \
cdt
load 123-W2A.asy \
                                                                           561
token  q.coef   exp.mem> q.coef
integer scalar  extracted.flag
\
   ^*************************************************************************

\
   ^*************************************************************************

: get.line.#   \ [ string -- ]                                            566
    \ %--------  Remember to initial #.line to 0
    "dup  cr  s.type.3
    "len   tmp.v.i.3  :=
    0      tmp.v.i.2  :=
    begin                                                                  571
      tmp.v.i.2  1 +   tmp.v.i.2  :=
      \  ."  " tmp.v.i.2  .
      "dup  "upper
      123.str.ary  "[ tmp.v.i.2 ]  1  tmp.v.i.3  "sub  "upper  "=
     tmp.v.i.2  #.col  =   or                                              576
    until
    \ "drop
    "upper  123.str.ary  "[ tmp.v.i.2 ]  1  tmp.v.i.3  "sub  "upper  "=
        not
    tmp.v.i.2  #.col  =   and
    if                                                                     581
      cr  ." Array not found - Exit!"
      exit
    else
      #.line  1  +   #.line  :=
    then                                                                   586
```

```
    tmp.v.i.2       line.#   [ #.line ]   :=
    ."  No " 2 0 fix.format    #.line    n.type
    ."  found at " tmp.v.i.2   n.type
;
                                                                                591
dir.asy.sys         " 123io.sov" "cat   defer>   load.overlay
: extract.wks    \   [   123.file.name    -- ]
  123.file.name   ":=
  \ %--------------- Open WKS
     ------------------------------------------------
  cr ." Opening WKS file : "   123.file.name    s.type                          596
  ."  --- "   "   Wait " s.type.2
  dir.asy.sys         " 123io.sov" "cat   defer>   load.overlay
  123.file.name   defer>    123file.open
  \ %--------------- Get all column names
     ------------------------------------
  cr   ." -->Str:"                                                              601
  "   "    123.str.ary    ":=
  1        1
  1        100
  123read.range
  123.str.ary                                                                   606
  123file>"
  "   Done." s.type.3
  \ %--------------- Find the column number for the specification string
     ------
  cr ." -->Spe:"
  0   #.line   :=                                                               611
  " $$"    \ cell flag for specification cell
  "dup   s.type
  get.line.#
  \ %-------------   Get specification string
     --------------------------------
  1      line.# [ #.line ]                                                      616
  1      1
  123read.range
  tmp.s
  123file>"
  tmp.s   "len   2 -   3   swap   "sub     tmp.s    ":=                         621
  tmp.s   s.type.3
  \ %-------------   Find specification parameters
     ----------------------------
  tmp.s spe.str.1 ":=
  tmp.s
  \ " 12345"   "cat     \   strange behavior here                               626
  "null "cat           \   strange behavior here
  \   \ "dup s.type.2
  tmp.s      ascii ,   "number    #.col     :=    ?drop
  tmp.s    ":=
  tmp.s      ascii )   "number    #.row     :=    ?drop                        631
  tmp.s    ":=
  \   tmp.s      ascii -   "number    tmp.v.i   :=    ?drop
  \   tmp.s    ":=
  tmp.s    ":=   \ recover tmp.s --- need the line : "null "cat !
  \ %%-------------   Read data                                                  636
```



```
     ------------------------------------------------
  cr ." -->Data:"
  11        1
  #.row    #.col
  123read.range   \ \ in double precison
                                                                                641
  123file>unnamed.array
  becomes> q.coef
  q.coef   trans[ 1 , 2 ]   becomes> q.coef
  \ %%-------------   Close WKS
     ------------------------------------------------
  123file.close                                                                 646
  release.overlay
  1   extracted.flag   :=
  "   Done." s.type.3
;
release.overlay                                                                 651

: set.def
\    1      grid.flag                  :=
  0      grid.flag                  :=
  1      put.lgn.flag               :=                                         656
  1      put.d&t.flag               :=
  1      put.spe.flag               :=
  1      put.abc.flag               :=
  0      plot.#                     :=
  0      acc.plot.#                 :=                                         661
  0      #.line                     :=
  1      eps.file.010203.flag       :=
  " 01.eps" eps.file.name         ":=
  " y"   non.stop.flag            ":=   \ for eps.file
  3      spe.str.2.or.3             :=   \ use   spe.str.2   or   spe.str.3    666
  \ 1      new.d&t.flag               :=
  change.d&t
;

\                                                                               671
    ^*************************************************************************

\ Don't change here
\
    ^*************************************************************************

  set.def
\   1 set.lc
  set.mon                                                                       676
  sd
  do.plot
\
    ^*************************************************************************

\
    ^*************************************************************************

\                                                                               681
```

```
    ^*****************************************************************************

\ \ %=============================================================
\    0  set.lc
\    \ set.mon
\    set.eps                                                          686
\    DO.PLOT.WKS  \ FOR AUTO PLOT
\ \ %=============================================================
\ %==============================================================
: eps.plot
  \ 0  set.lc                                                        691
  \ set.mon
  set.eps
  DO.PLOT.WKS  \ FOR AUTO PLOT
;
\ %==============================================================    696
: mon.plot
  \ 1  set.lc
  set.mon
  \ set.eps
  DO.PLOT.WKS  \ FOR AUTO PLOT                                       701
;
\ %==============================================================
\ 1 string output.flag.str
: output.plot
  output.flag.str "upper                                             706
  " E" "= if eps.plot else mon.plot then
;
output.plot

.............................................................................................
```

FigABP.bpf

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```
: FigABP.bpf ; \ %----- Asyst Prog                                              1

\ ================================================================
" 1"  lgn.str.ary   "[ 1 ]   ":=
" 2"  lgn.str.ary   "[ 2 ]   ":=
" 3"  lgn.str.ary   "[ 3 ]   ":=                                               6
" 4"  lgn.str.ary   "[ 4 ]   ":=
" 5"  lgn.str.ary   "[ 5 ]   ":=
" 6"  lgn.str.ary   "[ 6 ]   ":=
\ " a"  get.lgns.a.or.d     ":=
                                                                               11
\ ----------------------------------------------------------------
\ ^--------------------------------------------------------------
\ %% Define Coherence pairs and file names
\ ^--------------------------------------------------------------
\ ----------------------------------------------------------------              16
  \      set.eps
  \      set.mon
  \ %--------------------------------------------------------------
  \ %--------------------------------------------------------------
  1      grid.flag                :=                                            21
  1      put.lgn.flag             :=
  1      put.d&t.flag             :=
  1      put.spe.flag             :=
  1      put.abc.flag             :=
  0      plot.#                   :=                                            26
  0      #.line                   :=
  0      eps.file.010203.flag     :=
  \  2      spe.str.2.or.3          :=  \ use  spe.str.2  or  spe.str.3
  3      spe.str.2.or.3           :=  \ use  spe.str.2  or  spe.str.3
  "null  pre.abc.str             ":=                                           31
  " n"   my.pause.flag           ":=
  " y"   non.stop.flag           ":=  \ for eps.file
  \ %--------------------------------------------------------------
  " Scale (~ Frequency in Hz)"                          x.label      ":=
  " Coherence"                                          y.label      ":=      36
  spe.str.1                          misce.str    ":=  \ reassign
     misce.str
  \ " Depth Effect"                  misce.str    ":=  \ reassign
     misce.str
  "null                              spe.str.2    ":=
  " TEST"                            spe.str.2    ":=
\ ----------------------------------------------------------------              41
 \     set.eps
 \      set.mon
\ ^--------------------------------------------------------------
\ %    Calling sequence
\ %      plot.bat                                                               46
\ %      get.plotted  <-- get.line.#
\ %      fig.body
\ %--------------------------------------------------------------
\ ^--------------------------------------------------------------
```



```
\ ^*****************************       WC                                   51
   *****************************
\ ^--------------------------------------------------------------------
\ ^*****************************    B series
   *****************************
\ ^--------------------------------------------------------------------
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  Wind Waves
\ % Rain intensity : small <- b0 b4 b3 b1 -> large                         56
\ %% ==============================    XY range
   ==============================
\ %--------------------------------------------------------------------
   " x0y0"  axis.fit.flag   ":=
   8   8    axis.divisions
   0.       x.min.w          :=                                           61
   8.0      x.max.w          :=
   0.       y.min.w          :=
   1.0      y.max.w          :=
   " WC_R-"    pre.abc.str             ":=
\ %--------------------------------------------------------------------   66
\ %% ==============================----------------
   ================================
\ %% ============================    Variable
   ================================
\ %% ============================       R
   ================================
   " WC_R-"    pre.abc.str          ":=
   -32      plot.#                 :=              \  A, B, C, ... (  0: 65  71
       -> A)
                                                   \  a, b, c, ... (-32: 97
                                                     -> a)
\ %--------------------------------------------------------------------
\ R-(C2-a
   " aR124-2.WC"  eps.file.name  ":=
   " @-pairs"                                                              76
   " a0124-0122"
   " a3124-3122"
   " a2124-2122"
   " a1124-1122"
   plot.bat                                                                81
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-b
   " aR224-2.WC"  eps.file.name  ":=
   " @-pairs"
   " a0224-0222"                                                           86
   " a3224-3222"
   " a2224-2222"
   " a1224-1222"
   plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~                                     91
\ R-(C2-c
   " aR324-2.WC"  eps.file.name  ":=
   " @-pairs"
   " a0324-0322"
   " a3324-3322"                                                           96
   " a2324-2322"
```

```
  " a1324-1322"
  plot.bat
\ %% ============================       R (d3)
   ================================
\ %-------------------------------------------------------------------------
\ R-(C2-a
  " aR134-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0134-0132"
  " a3134-3132"
  " a2134-2132"
  " a1134-1132"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-b
  " aR234-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0234-0232"
  " a3234-3232"
  " a2234-2232"
  " a1234-1232"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-c
  " aR334-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0334-0332"
  " a3334-3332"
  " a2334-2332"
  " a1334-1332"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================       R (d4)
   ================================
\ %-------------------------------------------------------------------------
\ R-(C2-a
  " aR144-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0144-0142"
  " a3144-3142"
  " a2144-2142"
  " a1144-1142"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-b
  " aR244-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0244-0242"
  " a3244-3242"
  " a2244-2242"
  " a1244-1242"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-c
  " aR344-2.WC"  eps.file.name  ":=
```



```
  " @-pairs"
  " a0344-0342"
  " a3344-3342"
  " a2344-2342"
  " a1344-1342"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================       R (d5)
   ================================
\ %-------------------------------------------------------------------------
\ R-(C2-a
  " aR154-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0154-0152"
  " a3154-3152"
  " a2154-2152"
  " a1154-1152"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-b
  " aR254-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0254-0252"
  " a3254-3252"
  " a2254-2252"
  " a1254-1252"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ R-(C2-c
  " aR354-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0354-0352"
  " a3354-3352"
  " a2354-2352"
  " a1354-1352"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================---------------
   ================================
\ %% ============================    Variable
   ================================
\ %% ============================
   ================================
\ %% ============================     M (d2)
   ================================
  " WC_M-"     pre.abc.str          ":=
  -32       plot.#               :=              \  A, B, C, ... (  0: 65
      -> A)
                                                 \  a, b, c, ... (-32: 97
                                                    -> a)
\ %-------------------------------------------------------------------------
\ M-(C2-a
  " a0M24-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0124-0122"
```

```
  " a0224-0222"
  " a0324-0322"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-d
  " a3M24-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a3124-3122"
  " a3224-3222"
  " a3324-3322"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-c
  " a2M24-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a2124-2122"
  " a2224-2222"
  " a2324-2322"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-b
  " a1M24-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a1124-1122"
  " a1224-1222"
  " a1324-1322"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================      M  (d3)
   ================================
\ %-------------------------------------------------------------------
\ M-(C2-a
  " a0M34-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0134-0132"
  " a0234-0232"
  " a0334-0332"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-d
  " a3M34-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a3134-3132"
  " a3234-3232"
  " a3334-3332"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-c
  " a2M34-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a2134-2132"
  " a2234-2232"
  " a2334-2332"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



```
\ M-(C2-b
  " a1M34-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a1134-1132"
  " a1234-1232"
  " a1334-1332"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================      M  (d4)
   ================================
\ %-------------------------------------------------------------------
\ M-(C2-a
  " a0M44-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0144-0142"
  " a0244-0242"
  " a0344-0342"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-d
  " a3M44-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a3144-3142"
  " a3244-3242"
  " a3344-3342"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-c
  " a2M44-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a2144-2142"
  " a2244-2242"
  " a2344-2342"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-b
  " a1M44-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a1144-1142"
  " a1244-1242"
  " a1344-1342"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================      M  (d5)
   ================================
\ %-------------------------------------------------------------------
\ M-(C2-a
  " a0M54-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0154-0152"
  " a0254-0252"
  " a0354-0352"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-d
```

```
  " a3M54-2.WC"  eps.file.name  ":=                                  306
  " @-pairs"
  " a3154-3152"
  " a3254-3252"
  " a3354-3352"
  plot.bat                                                           311
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-c
  " a2M54-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a2154-2152"                                                      316
  " a2254-2252"
  " a2354-2352"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ M-(C2-b                                                            321
  " a1M54-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a1154-1152"
  " a1254-1252"
  " a1354-1352"                                                      326
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %% ============================----------------                  331
   ================================
\ %% ============================    Variable
   ================================
\ %% ============================
   ================================
\ %% ============================        D
   ================================
  " WC_D-"     pre.abc.str          ":=
  -32       plot.#                :=              \  A, B, C, ... (  0: 65  336
       -> A)
                                                  \  a, b, c, ... (-32: 97
                                                     -> a)
\ %-------------------------------------------------------------------
\ %% ============================     D (m1)
   ================================
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ D-(C3-a                                                            341
  " a01D4-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a0124-0122"
  " a0134-0132"
  " a0144-0142"                                                      346
  " a0154-0152"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ D-(C3-d
  " a31D4-2.WC"  eps.file.name  ":=                                  351
  " @-pairs"
  " a3124-3122"
```



```
  " a3134-3132"
  " a3144-3142"
  " a3154-3152"                                                      356
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ D-(C3-c
  " a21D4-2.WC"  eps.file.name  ":=
  " @-pairs"                                                         361
  " a2124-2122"
  " a2134-2132"
  " a2144-2142"
  " a2154-2152"
  plot.bat                                                           366
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ D-(C3-b
  " a11D4-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a1124-1122"                                                      371
  " a1134-1132"
  " a1144-1142"
  " a1154-1152"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  376
\ %% ============================      D (m2)
   ================================
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ D-(C3[B]-a
  " a02D4-2.WC"  eps.file.name  ":=
  " @-pairs"                                                         381
  " a0224-0222"
  " a0234-0232"
  " a0244-0242"
  " a0254-0252"
  plot.bat                                                           386
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ C3[B]-d
  " a32D4-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a3224-3222"                                                      391
  " a3234-3232"
  " a3244-3242"
  " a3254-3252"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  396
\ D-(C3[B]-c
  " a22D4-2.WC"  eps.file.name  ":=
  " @-pairs"
  " a2224-2222"                                                      401
  " a2234-2232"
  " a2244-2242"
  " a2254-2252"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ D-(C3[B]-b                                                         406
  " a12D4-2.WC"  eps.file.name  ":=
```

```
   " @-pairs"
   " a1224-1222"
   " a1234-1232"
   " a1244-1242"                                                    411
   " a1254-1252"
   plot.bat
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\  %% ==============================      D (m3)
     ================================
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~   416
\  D-(C3[B-4]-a
   " a03D4-2.WC"  eps.file.name   ":=
   " @-pairs"
   " a0324-0322"
   " a0334-0332"                                                    421
   " a0344-0342"
   " a0354-0352"
   plot.bat
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\  D-(C3[B-4]-d                                                     426
   " a33D4-2.WC"  eps.file.name   ":=
   " @-pairs"
   " a3324-3322"
   " a3334-3332"
   " a3344-3342"                                                    431
   " a3354-3352"
   plot.bat
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\  D-(C3[B-4]-c
   " a23D4-2.WC"  eps.file.name   ":=                               436
   " @-pairs"
   " a2324-2322"
   " a2334-2332"
   " a2344-2342"
   " a2354-2352"                                                    441
   plot.bat
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\  D-(C3[B-4]-b
   " a13D4-2.WC"  eps.file.name   ":=
   " @-pairs"                                                       446
   " a1324-1322"
   " a1334-1332"
   " a1344-1342"
   " a1354-1352"
   plot.bat                                                         451
\  ^------------------------------------------------------------------
\  ^*******************************    F series
     *******************************
\  ^------------------------------------------------------------------
\  %------------------------------------------------------------------
   " x0y0"  axis.fit.flag   ":=                                     456
   0.       x.min.w          :=
   10.      x.max.w          :=
   0.       y.min.w          :=
   1.0      y.max.w          :=
```



```
\  %% ==============================    D (f-w6)                     461
     ================================
\  %------------------------------------------------------------------
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
:  tmp
\  C3[C]-a
   " f06D2-1.WC"  eps.file.name   ":=                               466
   " @-pairs"
   " f0622-0621"
   " f0632-0631"
   " f0642-0641"
   " f0652-0651"                                                    471
   " f0692-0691"
   plot.bat
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\  C3[C]-b
   " f16D2-1.WC"  eps.file.name   ":=                               476
   " @-pairs"
   " f1622-1621"
   " f1632-1631"
   " f1642-1641"
   " f1652-1651"                                                    481
   " f1692-1691"
   plot.bat
\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
;
```

C-CC-A.BPF

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```
\ ^-------------------------------------------------------------------
\ %%  C-Spe-F6
\ %%
\ %%
\ %%
\ %%
\ %%
\ ^-------------------------------------------------------------------
\ \\ -----------------------------------------------------------------
\ %% String assignment
\      0.  misce.str -- at Top Left, can be assigned in FB(2)
\      1.  spe.str.1 -- provided by wks file (element at row 1 column
   last)
\      2.  spe.str.2 or spe.str.3 -- (CASE) above Legend, use
   spe.str.2.or.3
\            spe.str.2: can be assigned in FB(2)
\            spe.str.3: default to eps.file.name, not changeable, see
   plot.bat
\      3   123.str.ary or lgn.str.ary -- Legends for lines, use
   get.lgns.a.or.d
\            123.str.ary: provided by wks file (first row)
\            lgn.str.ary: can be assigned in FB2
\ \\ -----------------------------------------------------------------
" 1"  lgn.str.ary   "[ 1 ]   ":=
" 2"  lgn.str.ary   "[ 2 ]   ":=
" 3"  lgn.str.ary   "[ 3 ]   ":=
" 4"  lgn.str.ary   "[ 4 ]   ":=
" 5"  lgn.str.ary   "[ 5 ]   ":=
" 6"  lgn.str.ary   "[ 6 ]   ":=
\ " a"  get.lgns.a.or.d     ":=

\ ----------------------------------------------------------------------
\ ^----------------------------------------------------------------------
\ %% Define Coherence pairs and file names \
\ ----------------------------------------------------------------------
  " n"  my.pause.flag           ":=
  " y"  non.stop.flag           ":=  \ for eps.file
\ ----------------------------------------------------------------------
\   1     grid.flag               :=
  1     put.lgn.flag            :=
  1     put.d&t.flag            :=
  1     put.spe.flag            :=
  1     put.abc.flag            :=
  1     put.pre.abc.flag        :=
  1     put.post.abc.flag       :=
  0     plot.#                  :=
  0     #.line                  :=
  0     eps.file.010203.flag    :=
  \  2     spe.str.2.or.3          :=  \ use  spe.str.2  or  spe.str.3
  3     spe.str.2.or.3          :=  \ use  assigned(2) or default(3)
  "null pre.abc.str           ":=
```



```
  "null post.abc.str          ":=
  \ %-----------------------------------------------------------------
  " Scale (~ Frequency in Hz)"      x.label       ":=
  " Wavelet coherence"              y.label       ":=
  spe.str.1                         misce.str     ":=  \ reassign
     misce.str
  "null                             spe.str.2     ":=
\ ----------------------------------------------------------------------
\ ----------------------------------------------------------------------
\ ^----------------------------------------------------------------------
\ %     Calling sequence
\ %       plot.bat
\ %       get.plotted  <-- get.line.#
\ %       fig.body
\ %----------------------------------------------------------------------
\ ^----------------------------------------------------------------------
\ ^*******************************       WC
   *******************************
\ ^----------------------------------------------------------------------
\ ^*******************************    B series
   *******************************
\ ^----------------------------------------------------------------------
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  Wind Waves
\ % Rain intensity : small <- b0 b4 b3 b1 -> large
\ %% ============================    XY range
    ================================
\ %----------------------------------------------------------------------
  " x0y0"  axis.fit.flag   ":=
  8    8     axis.divisions
  0.         x.min.w          :=
  8.0        x.max.w          :=
  0.         y.min.w          :=
  1.0        y.max.w          :=
  \ %-----------------------------------------------------------------
  0          x.lp.pos         :=  \ For label.points
  2          x.lp.inc         :=
  0          y.lp.pos         :=
  2          y.lp.inc         :=
\ %----------------------------------------------------------------------
\ %----------------------------------------------------------------------
\ %% ================================----------
    ================================
\ %%     Variable    ================================
\ %%        D        ================================
  " Wavelet(a1&3)-CC-D-"    pre.abc.str          ":=
  " (s0.6) "                post.abc.str         ":=
  -0                plot.#                 :=  \  A, B, C, ... (-32: 65 -> A)
                                                \  a, b, c, ... (  0: 97 -> a)
\ %----------------------------------------------------------------------
" 3 & 4 cm"  lgn.str.ary   "[ 1 ]   ":=
" 3 & 5   "  lgn.str.ary   "[ 2 ]   ":=
" 4 & 5   "  lgn.str.ary   "[ 3 ]   ":=
" 5   "  lgn.str.ary   "[ 4 ]   ":=
" 9   "  lgn.str.ary   "[ 5 ]   ":=
" 6"  lgn.str.ary   "[ 6 ]   ":=
```

```
" a"  get.lgns.a.or.d     ":=
\ %-------------------------------------------------------------------
  " a01D2.CC"  eps.file.name  ":=
  " @-pairs"
  " a0132-0142"
  " a0132-0152"
  " a0142-0152"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  " a11D2.CC"  eps.file.name  ":=
  " @-pairs"
  " a1132-1142"
  " a1132-1152"
  " a1142-1152"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\ %-------------------------------------------------------------------
  " (s3.0) "            post.abc.str             ":=
  \ ---------------------------------------- ■
  " a03D2.CC"  eps.file.name  ":=
  " @-pairs"
  " a0332-0342"
  " a0332-0352"
  " a0342-0352"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  " a13D2.CC"  eps.file.name  ":=
  " @-pairs"
  " a1332-1342"
  " a1332-1352"
  " a1342-1352"
  plot.bat
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

101 106 111 116 121 126 131

C-Fx.bpf

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```
: C-WC-4F.bpf ; \ %----- Asyst Prog                                          1
\ ==========================================================================
" 1"  lgn.str.ary   "[ 1 ]   ":=
" 2"  lgn.str.ary   "[ 2 ]   ":=
" 3"  lgn.str.ary   "[ 3 ]   ":=
" 4"  lgn.str.ary   "[ 4 ]   ":=                                            6
" 5"  lgn.str.ary   "[ 5 ]   ":=
" 6"  lgn.str.ary   "[ 6 ]   ":=
\ " a"  get.lgns.a.or.d     ":=

\ --------------------------------------------------------------------------
\ ^------------------------------------------------------------------------
\ %% Define Coherence pairs and file names                                  11
\ ^------------------------------------------------------------------------
\ --------------------------------------------------------------------------
  " n"  my.pause.flag           ":=
  " y"  non.stop.flag           ":=   \ for eps.file                        16
\ --------------------------------------------------------------------------
\   1      grid.flag                :=
  1      put.lgn.flag             :=
  1      put.d&t.flag             :=                                        21
  1      put.spe.flag             :=
  1      put.abc.flag             :=
  1      put.pre.abc.flag         :=
  1      put.post.abc.flag        :=
  0      plot.#                   :=                                        26
  0      #.line                   :=
  0      eps.file.010203.flag     :=
  \  2      spe.str.2.or.3           :=   \ use  spe.str.2  or  spe.str.3
  3      spe.str.2.or.3           :=   \ use  assigned(2) or default(3)
  "null  pre.abc.str              ":=                                       31
  "null  post.abc.str             ":=
  \ %----------------------------------------------------------------------
  " Scale (~ Frequency in Hz)"       x.label       ":=
  " Wavelet coherence (P:x)"         y.label       ":=
  spe.str.1                          misce.str     ":=   \ reassign        36
     misce.str
  "null                              spe.str.2     ":=
\ --------------------------------------------------------------------------
\ --------------------------------------------------------------------------
 \     set.eps
 \       set.mon                                                           41
\ ^------------------------------------------------------------------------
\ %     Calling sequence
\ %       plot.bat
\ %       get.plotted  <-- get.line.#
\ %       fig.body                                                          46
\ %----------------------------------------------------------------------
\ ^------------------------------------------------------------------------
\ ^*****************************       WC
   *****************************
\ ^------------------------------------------------------------------------
```



```
\ ^*****************************    B series                               51
   *****************************
\ ^------------------------------------------------------------------------
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  Wind Waves
\ % Rain intensity : small <- b0 b4 b3 b1 -> large
\ %% ==============================    XY range
   ================================
\ %----------------------------------------------------------------------  56
  " x0y0"  axis.fit.flag   ":=
  8    8     axis.divisions
  0.         x.min.w          :=
  8.0        x.max.w          :=
  0.         y.min.w          :=                                          61
  1.0        y.max.w          :=
  \ 0.5       y.max.w           :=
  \ %------------------------------------------------------------------
  0          x.lp.pos         :=   \ For label.points
  2          x.lp.inc         :=                                          66
  0          y.lp.pos         :=
  2          y.lp.inc         :=
\ %----------------------------------------------------------------------
\ %% ==============================----------
   ================================
\ %% ==============================    Variable                           71
   ================================
\ %% ==============================       D
   ================================
  " WC_D-"     pre.abc.str          ":=
  -32        plot.#               :=              \  A, B, C, ... (  0: 65
      -> A)
                                                  \  a, b, c, ... (-32: 97
                                                     -> a)
\ %----------------------------------------------------------------------  76
\ %----------------------------------------------------------------------
" 2 cm"  lgn.str.ary   "[ 1 ]   ":=
" 3    "  lgn.str.ary   "[ 2 ]   ":=
" 4    "  lgn.str.ary   "[ 3 ]   ":=
" 5    "  lgn.str.ary   "[ 4 ]   ":=                                      81
" 9    "  lgn.str.ary   "[ 5 ]   ":=
" 6"  lgn.str.ary   "[ 6 ]   ":=

" a"  get.lgns.a.or.d     ":=
\ %----------------------------------------------------------------------  86
\ D
  " f06D2-1.WC"  eps.file.name   ":=
  " @-pairs"
  " f0622-0621"
  " f0632-0631"                                                            91
  " f0642-0641"
  " f0652-0651"
  " f0692-0691"
  plot.bat
\ %----------------------------------------------------------------------  96
\ D
  " f16D2-1.WC"  eps.file.name   ":=
```

```
  " @-pairs"
  " f1622-1621"
  " f1632-1631"                                                    101
  " f1642-1641"
  " f1652-1651"
  " f1692-1691"
  plot.bat
\ %--------------------------------------------------------------------      106
\ %--------------------------------------------------------------------
" a"  get.lgns.a.or.d     ":=
" d"  get.lgns.a.or.d     ":=
\ %--------------------------------------------------------------------
\ R                                                                      111
  " fR622-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0622-0621"
  " f1622-1621"
  plot.bat                                                               116
  " fR632-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0632-0631"
  " f1632-1631"
  plot.bat                                                               121
  " fR642-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0642-0641"
  " f1642-1641"
  plot.bat                                                               126
  " fR652-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0652-0651"
  " f1652-1651"
  plot.bat                                                               131
  " fR692-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0692-0691"
  " f1692-1691"
  plot.bat                                                               136
\
    %-------------------------------------------------------------------------

\ f0 only
  " f0622-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0622-0621"                                                          141
\   " f1622-1621"
  plot.bat
  " f0632-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0632-0631"                                                          146
\   " f1632-1631"
  plot.bat
  " f0642-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0642-0641"                                                          151
```



```
\   " f1642-1641"
  plot.bat
  " f0652-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0652-0651"                                                          156
\   " f1652-1651"
  plot.bat
  " f0692-1.WC"  eps.file.name  ":=
  " @-pairs"
  " f0692-0691"                                                          161
\   " f1692-1691"
  plot.bat
\
    %-------------------------------------------------------------------------

\ f1 only
  " f1622-1.WC"  eps.file.name  ":=                                      166
  " @-pairs"
\   " f0622-0621"
  " f1622-1621"
  plot.bat
  " f1632-1.WC"  eps.file.name  ":=                                      171
  " @-pairs"
\   " f0632-0631"
  " f1632-1631"
  plot.bat
  " f1642-1.WC"  eps.file.name  ":=                                      176
  " @-pairs"
\   " f0642-0641"
  " f1642-1641"
  plot.bat
  " f1652-1.WC"  eps.file.name  ":=                                      181
  " @-pairs"
\   " f0652-0651"
  " f1652-1651"
  plot.bat
  " f1692-1.WC"  eps.file.name  ":=                                      186
  " @-pairs"
\   " f0692-0691"
  " f1692-1691"
  plot.bat
```

WPon22A1.BPF

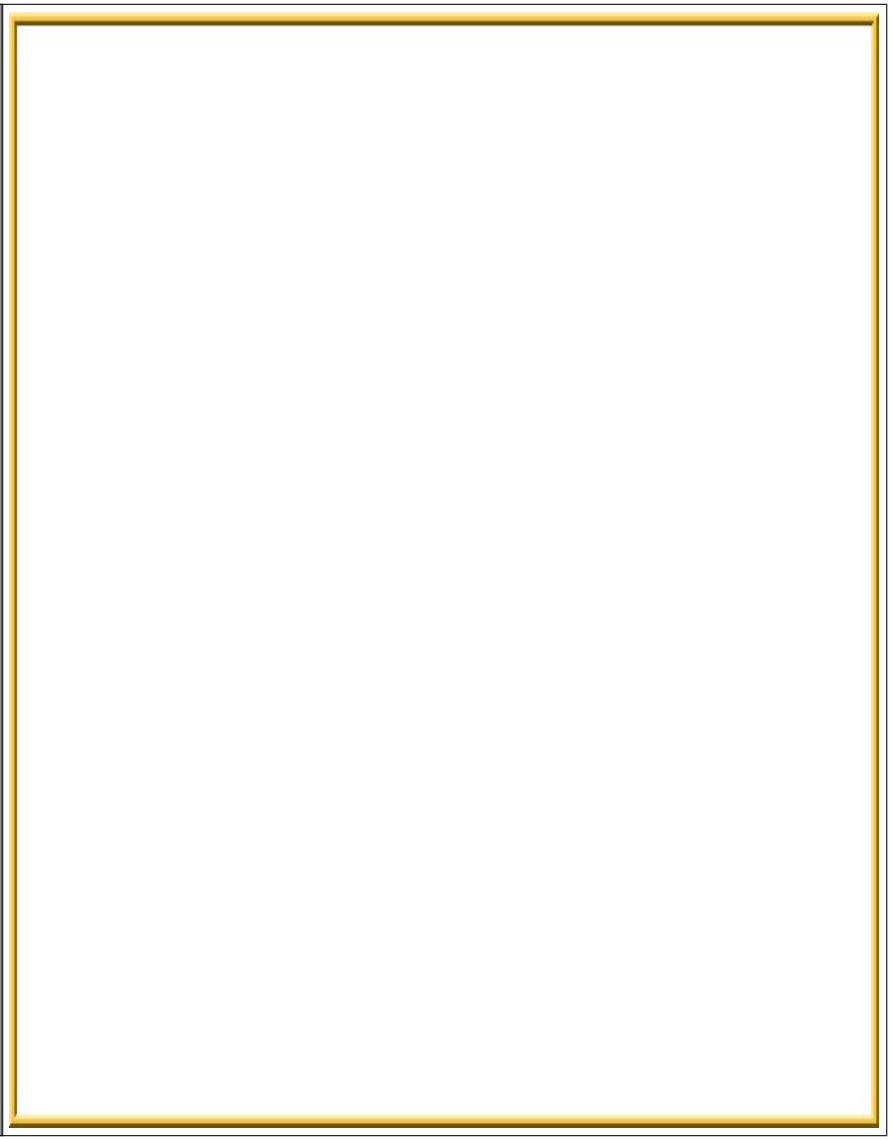
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```
\ %% Wavelet Blowup  -*- txt:asy -*-                                          1
\ ------------------------------------------------------------------------
\      misce.str                          d&t    spe.str.1 : From wks $$Mark
\      ----------------------------------        spe.str.2 : Assigned
\      | X(a)Y      Case (spe.str.2.or.3) |     spe.str.3 : eps.file.name
\      |             lgn1 (put.lgn.flag)  |                                  6
\      |             lgn2                 |     123.str.ary : From wks 1st
   row (d)
\      Y|                                 |     lgn.str.ary : Assigned (a)
\      |                                  |
\      |                                  |     Case :
\      |                                  |     (put.spe.flag and           11
   spe.str.2.or.3)
\      ----------------------------------        Legend :
\                        X                       (put.lgn.flag and
   get.lgns.a.or.d)
\ ------------------------------------------------------------------------
\ %% String assignment
\      0.  misce.str -- at Top Left, can be assigned in FB(2)                16
\      1.  spe.str.1 -- provided by wks file (element at row 1 column
   last)
\      2.  spe.str.2 or spe.str.3 -- For (CASE) above Legend, use
   spe.str.2.or.3
\           spe.str.2: can be assigned in FB(2)
\           spe.str.3: default to eps.file.name, not changeable, see
   plot.bat
\      3   123.str.ary or lgn.str.ary -- Legends for lines, use           21
   get.lgns.a.or.d
\           123.str.ary: provided by wks file (first row)
\           lgn.str.ary: can be assigned in FB2
\ ------------------------------------------------------------------------
\ ========================================================================
  " n"  my.pause.flag ":=                                                   26
  " y"  non.stop.flag ":=  \ for eps.file
  1 eps.file.010203.flag :=
  0 #.line                :=
\ ========================================================================
  \ ---------------------------------------- ■ figure annotation            31
  1 put.lgn.flag    :=
  1 put.d&t.flag    := \ at top right corner
  1 put.spe.flag    := \ (CASE) above Legend
  3 spe.str.2.or.3 := \ use spe.str.3 (eps.file.name) for (CASE)
  2 spe.str.2.or.3 := \ use spe.str.2 (assigned) for (CASE)                 36
  0 x.lp.pos        := \ for label.points
  2 x.lp.inc        :=
  0 y.lp.pos        :=
  2 y.lp.inc        :=
 " d"               get.lgns.a.or.d ":= \ use Assigned or Default lgn      41
  spe.str.1         misce.str       ":= \ at top left corner
  "null             spe.str.2       ":=
  " 1"  lgn.str.ary  "[ 1 ]  ":=
  " 2"  lgn.str.ary  "[ 2 ]  ":=
```



```
  " 3"  lgn.str.ary  "[ 3 ]  ":=                                            46
  " 4"  lgn.str.ary  "[ 4 ]  ":=
  " 5"  lgn.str.ary  "[ 5 ]  ":=
  " 6"  lgn.str.ary  "[ 6 ]  ":=
  \ ---------------------------------------- ■ labeling a, b, .. subfigs
  0   put.abc.flag       := \ for labeling subfigs, e.g., (a)              51
  1   put.pre.abc.flag   := \ e.g. M-(a)
  1   put.post.abc.flag  := \ e.g. M-(a)-5
  -32 plot.#             := \  A, B, .. (-32: 65 -> A)
  -0  plot.#             := \  a, b, .. (  0: 97 -> a)
  "null               pre.abc.str  ":=                                      56
  "null               post.abc.str ":= \ "null
\ ========================================================================
  \ ---------------------------------------- ■ axes
  1       grid.flag              :=
  " x0y1" axis.fit.flag          ":=                                        61
  10   8  axis.divisions
  0.      x.min.w                :=
  500.    x.max.w                :=
  -4.     y.min.w                :=
  4.      y.max.w                :=                                         66
  0       Find.y.MinMax.flag     := \ 0: disable G.or.L.y.MinMax.Flag
  1       Find.y.MinMax.flag     := \ 1: recalculate y.min.w and y.max.w
  " G"    G.or.L.y.MinMax.Flag ":= \ full global q array (include
     unlisted cols)
  " L"    G.or.L.y.MinMax.Flag ":= \ all local listed and exclude
     unlisted cols
  " Point series"      x.label       ":=                                   71
  " Coefficient"       y.label       ":=
\ ========================================================================
\ ========================================================================
" Wavelet packet"         pre.abc.str   ":=
  "  (" G.or.L.y.MinMax.Flag "cat " )" "cat  post.abc.str        ":=       76
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
" WP1on22A"  eps.file.name   ":=
" ON22A"  eps.file.name   ":=
1 eps.file.010203.flag :=
2 spe.str.2.or.3 := \ use spe.str.2 (assigned) for (CASE)                   81
" 1" eps.file.name "cat eps.file.010203.root ":= \ for eps output file
   name
eps.file.name spe.str.2             ":= \ for case labeling
" @-PAIRS"
" P1L1"
 plot.bat                                                                   86
\ ========================================================================
" @-PAIRS"
" P1L2"
 plot.bat
\ ========================================================================   91
" @-PAIRS"
" P1L3"
 plot.bat
\ ========================================================================
" @-PAIRS"                                                                  96
" P1L4"
```

```
plot.bat
\ ============================================================
```



WPon22A2.BPF

A01786-20161209-A040 ❖ December 9, 2016 ❖ [Page count: 3]

```
\ %% Wavelet Blowup  -*- txt:asy -*-                                          1
\ ------------------------------------------------------------------------
\      misce.str                          d&t    spe.str.1 : From wks $$Mark
\      ----------------------------------        spe.str.2 : Assigned
\      | X(a)Y      Case (spe.str.2.or.3) |     spe.str.3 : eps.file.name
\      |             lgn1 (put.lgn.flag)  |                                  6
\      |             lgn2                 |     123.str.ary : From wks 1st
   row (d)
\      Y|                                 |     lgn.str.ary : Assigned (a)
\      |                                  |
\      |                                  |     Case :
\      |                                  |     (put.spe.flag and           11
   spe.str.2.or.3)
\      ----------------------------------        Legend :
\                        X                       (put.lgn.flag and
   get.lgns.a.or.d)
\ ------------------------------------------------------------------------
\ %% String assignment
\     0.  misce.str -- at Top Left, can be assigned in FB(2)                 16
\     1.  spe.str.1 -- provided by wks file (element at row 1 column
   last)
\     2.  spe.str.2 or spe.str.3 -- For (CASE) above Legend, use
   spe.str.2.or.3
\           spe.str.2: can be assigned in FB(2)
\           spe.str.3: default to eps.file.name, not changeable, see
   plot.bat
\     3   123.str.ary or lgn.str.ary -- Legends for lines, use            21
   get.lgns.a.or.d
\           123.str.ary: provided by wks file (first row)
\           lgn.str.ary: can be assigned in FB2
\ ------------------------------------------------------------------------
\ ========================================================================
  " n"  my.pause.flag ":=                                                  26
  " y"  non.stop.flag ":=  \ for eps.file
  1 eps.file.010203.flag :=
  0 #.line               :=
\ ========================================================================
  \ ---------------------------------------- ■ figure annotation           31
  1 put.lgn.flag    :=
  1 put.d&t.flag    := \ at top right corner
  1 put.spe.flag    := \ (CASE) above Legend
  3 spe.str.2.or.3 := \ use spe.str.3 (eps.file.name) for (CASE)
  2 spe.str.2.or.3 := \ use spe.str.2 (assigned) for (CASE)                36
  0 x.lp.pos        := \ for label.points
  2 x.lp.inc        :=
  0 y.lp.pos        :=
  2 y.lp.inc        :=
 " d"               get.lgns.a.or.d ":= \ use Assigned or Default lgn      41
  spe.str.1         misce.str       ":= \ at top left corner
  "null             spe.str.2       ":=
  " 1"  lgn.str.ary  "[ 1 ]  ":=
  " 2"  lgn.str.ary  "[ 2 ]  ":=
```



```
  " 3"  lgn.str.ary  "[ 3 ]  ":=                                           46
  " 4"  lgn.str.ary  "[ 4 ]  ":=
  " 5"  lgn.str.ary  "[ 5 ]  ":=
  " 6"  lgn.str.ary  "[ 6 ]  ":=
  \ ---------------------------------------- ■ labeling a, b, .. subfigs
  0   put.abc.flag      := \ for labeling subfigs, e.g., (a)               51
  1   put.pre.abc.flag  := \ e.g. M-(a)
  1   put.post.abc.flag := \ e.g. M-(a)-5
  -32 plot.#            := \  A, B, .. (-32: 65 -> A)
  -0  plot.#            := \  a, b, .. (  0: 97 -> a)
  "null              pre.abc.str  ":=                                      56
  "null              post.abc.str ":= \ "null
\ ========================================================================
  \ ---------------------------------------- ■ axes
  1       grid.flag             :=
  " x0y1" axis.fit.flag         ":=                                       61
  10   8  axis.divisions
  0.      x.min.w               :=
  500.    x.max.w               :=
  -4.     y.min.w               :=
  4.      y.max.w               :=                                        66
  0       Find.y.MinMax.flag    := \ 0: disable G.or.L.y.MinMax.Flag
  1       Find.y.MinMax.flag    := \ 1: recalculate y.min.w and y.max.w
  " G"    G.or.L.y.MinMax.Flag ":= \ full global q array (include
     unlisted cols)
  " L"    G.or.L.y.MinMax.Flag ":= \ all local listed and exclude
     unlisted cols
  " Point series"     x.label       ":=                                   71
  " Coefficient"      y.label       ":=
\ ========================================================================
\ ========================================================================
" Wavelet packet"         pre.abc.str   ":=
  "  (" G.or.L.y.MinMax.Flag "cat " )" "cat  post.abc.str        ":=       76
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
" WP1on22A"  eps.file.name   ":=
" ON22A"  eps.file.name   ":=
1 eps.file.010203.flag :=
2 spe.str.2.or.3 := \ use spe.str.2 (assigned) for (CASE)                  81
" 2" eps.file.name "cat eps.file.010203.root ":= \ for eps output file
   name
eps.file.name spe.str.2             ":= \ for case labeling
" @-PAIRS"
" P1L0"
 plot.bat                                                                  86
\ ========================================================================
" @-PAIRS"
" P1L1"
 plot.bat
\ ========================================================================  91
" @-PAIRS"
" P1L2"
 plot.bat
\ ========================================================================
" @-PAIRS"                                                                  96
" P1L3"
```

```
 plot.bat
\ ================================================================
" @-PAIRS"
" P1L4"                                                          101
 plot.bat
\ ================================================================
" @-PAIRS"
" P1L5"
 plot.bat                                                         106
\ ================================================================
```



WPon22A3.BPF

A01787-20161209-A041 ❖ December 9, 2016 ❖ [Page count: 3]

```
\ %% Wavelet Blowup  -*- txt:asy -*-                                          1
\ ------------------------------------------------------------------------
\      misce.str                          d&t    spe.str.1 : From wks $$Mark
\      ----------------------------------        spe.str.2 : Assigned
\      | X(a)Y      Case (spe.str.2.or.3) |     spe.str.3 : eps.file.name
\      |             lgn1 (put.lgn.flag)  |                                  6
\      |             lgn2                 |     123.str.ary : From wks 1st
   row (d)
\      Y|                                 |     lgn.str.ary : Assigned (a)
\      |                                  |
\      |                                  |     Case :
\      |                                  |     (put.spe.flag and           11
   spe.str.2.or.3)
\      ----------------------------------        Legend :
\                        X                       (put.lgn.flag and
   get.lgns.a.or.d)
\ ------------------------------------------------------------------------
\ %% String assignment
\     0.  misce.str -- at Top Left, can be assigned in FB(2)                 16
\     1.  spe.str.1 -- provided by wks file (element at row 1 column
   last)
\     2.  spe.str.2 or spe.str.3 -- For (CASE) above Legend, use
   spe.str.2.or.3
\           spe.str.2: can be assigned in FB(2)
\           spe.str.3: default to eps.file.name, not changeable, see
   plot.bat
\     3   123.str.ary or lgn.str.ary -- Legends for lines, use            21
   get.lgns.a.or.d
\           123.str.ary: provided by wks file (first row)
\           lgn.str.ary: can be assigned in FB2
\ ------------------------------------------------------------------------
\ ========================================================================
  " n"  my.pause.flag ":=                                                  26
  " y"  non.stop.flag ":=  \ for eps.file
  1 eps.file.010203.flag :=
  0 #.line               :=
\ ========================================================================
  \ ---------------------------------------- ■ figure annotation           31
  1 put.lgn.flag    :=
  1 put.d&t.flag    := \ at top right corner
  1 put.spe.flag    := \ (CASE) above Legend
  3 spe.str.2.or.3 := \ use spe.str.3 (eps.file.name) for (CASE)
  2 spe.str.2.or.3 := \ use spe.str.2 (assigned) for (CASE)                36
  0 x.lp.pos        := \ for label.points
  2 x.lp.inc        :=
  0 y.lp.pos        :=
  2 y.lp.inc        :=
 " d"               get.lgns.a.or.d ":= \ use Assigned or Default lgn      41
  spe.str.1         misce.str       ":= \ at top left corner
  "null             spe.str.2       ":=
  " 1"  lgn.str.ary  "[ 1 ]  ":=
  " 2"  lgn.str.ary  "[ 2 ]  ":=
```



```
  " 3"  lgn.str.ary  "[ 3 ]  ":=                                           46
  " 4"  lgn.str.ary  "[ 4 ]  ":=
  " 5"  lgn.str.ary  "[ 5 ]  ":=
  " 6"  lgn.str.ary  "[ 6 ]  ":=
  \ ---------------------------------------- ■ labeling a, b, .. subfigs
  0   put.abc.flag       := \ for labeling subfigs, e.g., (a)              51
  1   put.pre.abc.flag   := \ e.g. M-(a)
  1   put.post.abc.flag  := \ e.g. M-(a)-5
  -32 plot.#             := \  A, B, .. (-32: 65 -> A)
  -0  plot.#             := \  a, b, .. (  0: 97 -> a)
  "null              pre.abc.str   ":=                                     56
  "null              post.abc.str  ":= \ "null
\ ========================================================================
  \ ---------------------------------------- ■ axes
  1       grid.flag              :=
  " x0y1" axis.fit.flag          ":=                                       61
  10   8  axis.divisions
  0.      x.min.w                :=
  500.    x.max.w                :=
  -4.     y.min.w                :=
  4.      y.max.w                :=                                        66
  0       Find.y.MinMax.flag     := \ 0: disable G.or.L.y.MinMax.Flag
  1       Find.y.MinMax.flag     := \ 1: recalculate y.min.w and y.max.w
  " G"    G.or.L.y.MinMax.Flag ":= \ full global q array (include
     unlisted cols)
  " L"    G.or.L.y.MinMax.Flag ":= \ all local listed and exclude
     unlisted cols
  " Point series"      x.label       ":=                                  71
  " Coefficient"       y.label       ":=
\ ========================================================================
\ ========================================================================
" Wavelet packet"         pre.abc.str   ":=
  "  (" G.or.L.y.MinMax.Flag "cat " )" "cat  post.abc.str        ":=       76
\ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
" WP1on22A"  eps.file.name   ":=
" ON22A"  eps.file.name   ":=
1 eps.file.010203.flag :=
2 spe.str.2.or.3 := \ use spe.str.2 (assigned) for (CASE)                  81
" 3" eps.file.name "cat eps.file.010203.root ":= \ for eps output file
   name
eps.file.name spe.str.2             ":= \ for case labeling
" @-PAIRS"
" P1L0"
 plot.bat                                                                  86
\ ========================================================================
" @-PAIRS"
" P1L1"
 plot.bat
\ ========================================================================  91
" @-PAIRS"
" P1L2"
 plot.bat
\ ========================================================================
" @-PAIRS"                                                                  96
" P1L3"
```

```
 plot.bat
\ ================================================================
" @-PAIRS"
" P1L4"                                                          101
 plot.bat
\ ================================================================
" @-PAIRS"
" P1L5"
 plot.bat                                                         106
\ ================================================================
```



HT-word.asy


```
: HT-word ;  \ %----- Asyst Prog -*- txt:asy -*-                          1

\ ------------------------------------------------------------------
\  A small program piece which find the imaginary part of the real
   signal
\     based on the analytic signal method.
\  The program utizes complex integration rather than use direct        6
\     implemnentation of the Cauchy principal value integration.
\  The length of the array will be automatically truncated to some
\     maximun allowable power of 2.
\ ------------------------------------------------------------------
: my.hilbert                                                           11
  fft    []size    n.fft.pts   :=
  dup    becomes>  t1

  dup    sub[ 1 , n.fft.pts  2  /  ]
  0      +1      z=x+iy    *                                           16
  t1     sub[ 1 , n.fft.pts  2  /  ]  :=

         sub[ n.fft.pts  2  /  1 +   ,  n.fft.pts  2 / ]
  0      -1      z=x+iy    *
  t1     sub[ n.fft.pts  2  /  1 +   ,  n.fft.pts  2 / ]  :=           21

  t1     ifft
  zreal
;
\ ------------------------------------------------------------------    26
```

S_Mod.shl

A01792-20161219-A005 ❖ December 19, 2016 ❖ [Page count: 34]

```
: S_Mod.shl ; \ : LMod.asy ; \ %----- Asyst Prog -*- txt:asy -*-                1
\ ------------------------------------------------------------------
\ Amplitude, Phase, and Frequency modulations
\ ------------------------------------------------------------------
sd
def.vuport                                                                    6
xlyl
vertical axis.fit.on
integer scalar #.WEI                    scalar bpf.flag
        scalar #.frac                   scalar plot.bpf&hil
        scalar #.frac.2                 scalar spe.bpf.flag                  11
        scalar smo.flag                 scalar pt.beg
        scalar b.p.flag                 scalar pt.beg.2
        scalar channel.#                scalar pt.end.2
        scalar hil.flag                 scalar s.freq.ori
        scalar #.neg                    scalar ord.flag                      16
        scalar #.pos                    scalar non.stop.flag

real    scalar m.s.freq                 scalar b.p.s.2
        scalar m.s.freq.flag            scalar b.p.e.2
        scalar band.stop.hil            scalar b.p.t                         21
        scalar band.start.hil           scalar x.beg
        scalar b.p.s                    scalar x.end
        scalar b.p.e                    scalar mean.slope

1       string pha.or.amp               64      string spe.hil               26
1       string wnd.str                  64      string spe.bpf
12      string pcx.1                    32      string y.label
12      string pcx.2                    \ 14      string d&t.string
12      string pcx.3                    1       string mod.flag
12      string f.name.s                 2       string wave.type.str         31
64      string spe.gen                  8       string n.str1
12      string gp.name

cdtNow load get-x-n.asy \
cdtNow load to123-1.asy \                                                    36

token   ori.t   exp.mem>  ori.t         token   pha.t   exp.mem>  pha.t
token   alt.t   exp.mem>  alt.t         token   fre.t   exp.mem>  fre.t
token   inp.t   exp.mem>  inp.t         token   fre2.t  exp.mem>  fre2.t
token   qua.t   exp.mem>  qua.t         token   a.t     exp.mem>  a.t       41
token   env.t   exp.mem>  env.t         token   c.t     exp.mem>  c.t
token   hit.t   exp.mem>  hit.t         token   x.t     exp.mem>  x.t
token   hif.t   exp.mem>  hif.t         token   y.t     exp.mem>  y.t
token   bpt.t   exp.mem>  bpt.t         token   z.t     exp.mem>  z.t
token   bpf.t   exp.mem>  bpf.t         token   ps.t    exp.mem>  ps.t      46
token   tmp.t   exp.mem>  tmp.t

integer scalar  iii                     scalar  #.lines
        scalar  showflag                scalar  cut.f
        scalar  #.sec                   scalar  cut.f.p                      51
        scalar  line.#                  scalar  peak.flag
```



```
        scalar  c.#.b                   scalar  f.no.c
        scalar  h.c.flag                scalar  yfix.flag
        scalar  i.p.c                                                        56
dp.real scalar  v.min                   dp.real scalar  x.v.min
dp.real scalar  y.v.min                 dp.real scalar  x.v.max
dp.real scalar  y.v.max

real    dim[ 6 ] array  p.pos           dim[ 6 ] array  m.slo               61
        dim[ 6 ] array  p.neg

cdtNow load eps-word.asy \

real 5 ramp becomes> 123.ary.n                                               66
real 5 ramp becomes> 123.ary.n0
\ ================================================================
" bpf.pcx" pcx.1     ":=  \ Bandpass
" hil.pcx" pcx.2     ":=  \ Hilbert
" env.pcx" pcx.3     ":=  \ Envelope                                         71
" x"    wnd.str   ":=
0       plot.bpf&hil  :=
0       showflag :=
\ ---------------------------------------- -
1       ord.flag  :=  \ \\ this is system default value                      76
\ ---------------------------------------- -
0       m.s.freq.flag :=
\ 40      m.s.freq :=
\ ---------------------------------------- -
1024    #.fft.pts :=    \ a0m1020.2 sub[ 130 , 512 ] --> edge effects        81
0       smo.flag :=
1       x.conv.flag :=
1       pt.beg :=
4       channel.# :=
5       peak.flag :=                                                         86
1       b.p.flag :=
\ ---------------------------------------- -
1       hil.flag :=  \ Hilbert algorithm (Minimax or not)
25      #.wei :=
1.1     band.start.hil :=  \ Hilbert (symmetry)                              91
\ 5.5     band.start.hil :=  \ Hilbert (symmetry)
\ 3.5     band.start.hil :=  \ Hilbert (symmetry)
1       #.frac :=
\  4       #.frac.2 :=  \ not used  \ used when p.inc <> 1  --> computed
   in get.p.inc
\ \ ---------------------------------------- -                              96
\ 0.
\         x.beg :=
\ #.fft.pts 1 - float   m.s.freq float  /
\         x.end :=
\ \ ---------------------------------------- -                             101
\ 0       x.beg :=
\ 6       x.end :=
\ ---------------------------------------- -
\ ================================================================
: take.part                                                                 106
```

```
\    \ ---------------------------------------- -
\    0    x.beg :=
\    6    x.end :=
\    \ ---------------------------------------- -
   x.beg  s.freq *  ceiling  pt.beg.2  :=                                111
   pt.beg.2  1 +             pt.beg.2  :=
   x.end  s.freq *  floor    pt.end.2  :=
   pt.end.2  1 +             pt.end.2  :=
   sub[ pt.beg.2 , pt.end.2 pt.beg.2 - ]
   swap                                                                 116
   sub[ pt.beg.2 , pt.end.2 pt.beg.2 - ]
   swap
   world.coords
   horizontal
   axis.fit.off                                                         121
   x.beg  x.end  world.set
;
\ ================================================================
: set.bpf.hil
   i                                                                    126
   case
     1 of 45 #.wei := endof
     2 of 35 #.wei := endof
     3 of 35 #.wei := endof
     4 of 25 #.wei := endof                                             131
     5 of 25 #.wei := endof
   endcase
   wave.type.str " M1" "=
   if
     peak.flag                                                          136
     case
     1 of  1.2 band.start.hil :=  endof \  1.4  1.0  1.4
     2 of  2.4 band.start.hil :=  endof \  2.8  1.8  2.8
     3 of  3.6 band.start.hil :=  endof \  4.1  3.1  4.1
     4 of  4.8 band.start.hil :=  endof \  5.4  4.4  5.4                141
     5 of  6.0 band.start.hil :=  endof \  6.8  5.8  6.8
     6 of  7.2 band.start.hil :=  endof \  8.2  7.2  8.2
     endcase
   then
   wave.type.str " M2" "=                                               146
   if
     peak.flag
     case
     1 of  1.8 band.start.hil :=  endof \  2.2  1.2  2.2
     2 of  3.6 band.start.hil :=  endof \  4.4  3.4  4.4                151
     3 of  5.5 band.start.hil :=  endof \  6.5  5.5  6.5
     4 of  7.4 band.start.hil :=  endof \  8.5  7.5  8.5
     endcase
   then
   wave.type.str " M3" "=                                               156
   if
     peak.flag
     case
     1 of  2.0 band.start.hil :=  endof \  2.8  1.8  2.8
     2 of  4.0 band.start.hil :=  endof \  4.4  2.4  4.4                161
```



```
     3 of  6.0 band.start.hil :=  endof \  5.6  4.6  5.6
     4 of  8.0 band.start.hil :=  endof \  8.5  7.5  8.5
     endcase
   then
   wave.type.str " M4" "=                                               166
   if
     peak.flag
     case
     1 of  2.0 band.start.hil :=  endof \  2.8  1.8  2.8
     2 of  4.8 band.start.hil :=  endof \  4.4  2.4  4.4                171
     3 of  7.4 band.start.hil :=  endof \  5.6  4.6  5.6
     endcase
   then
   wave.type.str " W4" "=
   if                                                                   176
     peak.flag
     case
     1 of  2.6 band.start.hil :=  endof \  3.0  2.0  3.0
     2 of  4.7 band.start.hil :=  endof \  4.8  3.8  4.8
     3 of  6.8 band.start.hil :=  endof \  6.7  5.7  6.7                181
     4 of  8.5 band.start.hil :=  endof \  8.5  7.5  8.5
     endcase
   then
   wave.type.str " W5" "=
   if                                                                   186
     peak.flag
     case
     1 of  2.4 band.start.hil :=  endof \  2.8  1.8  2.8
     2 of  4.5 band.start.hil :=  endof \  4.8  3.8  4.8
     3 of  6.7 band.start.hil :=  endof \  6.7  5.7  6.7                191
     4 of  8.5 band.start.hil :=  endof \  8.5  7.5  8.5
     endcase
   then
   wave.type.str " W6" "=
   if                                                                   196
     peak.flag
     case
     1 of  2.0 band.start.hil :=  endof \  2.4  1.4  2.4
     2 of  4.0 band.start.hil :=  endof \  4.5  3.5  4.5
     3 of  6.0 band.start.hil :=  endof \  6.7  5.7  6.7                201
     4 of  8.0 band.start.hil :=  endof \  8.5  7.5  8.5
     endcase
   then
   \ ======================================== - Redefine band.stop.hil
   s.freq  2. /   band.start.hil -   band.stop.hil :=                   206
\    \ ---------------------------------------- -
\    \ Single Hilbert window
\    1.0 band.start.hil :=
\    s.freq  2. /   band.start.hil -   band.stop.hil :=
;                                                                       211
: set.bpf
   n.str1 "upper n.str1 ":=
   n.str1 4 "left 2 "right wave.type.str ":=

   set.bpf.hil                                                          216
```

```
wave.type.str " M1" "=
if
  peak.flag
  case
  1 of   1.4 b.p.s :=      1.4 b.p.e :=      1.0 b.p.t :=   endof
  2 of   2.8 b.p.s :=      2.8 b.p.e :=      1.0 b.p.t :=   endof
  3 of   4.1 b.p.s :=      4.1 b.p.e :=      1.0 b.p.t :=   endof
  4 of   5.4 b.p.s :=      5.4 b.p.e :=      1.0 b.p.t :=   endof
  5 of   6.8 b.p.s :=      6.8 b.p.e :=      1.0 b.p.t :=   endof
  6 of   8.2 b.p.s :=      8.2 b.p.e :=      1.0 b.p.t :=   endof
  endcase
then
wave.type.str " M2" "=
if
  peak.flag
  case
  1 of   2.2 b.p.s :=      2.2 b.p.e :=      1.0 b.p.t :=   endof
  2 of   4.4 b.p.s :=      4.4 b.p.e :=      1.0 b.p.t :=   endof
  3 of   6.5 b.p.s :=      6.5 b.p.e :=      1.0 b.p.t :=   endof
  4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
  endcase
then
wave.type.str " M3" "=
if
  peak.flag
  case
  1 of   2.4 b.p.s :=      2.4 b.p.e :=      1.0 b.p.t :=   endof \ 2.8 2
     .6
  2 of   4.8 b.p.s :=      4.8 b.p.e :=      1.0 b.p.t :=   endof \ 4.4 4
     .5
  3 of   7.0 b.p.s :=      7.0 b.p.e :=      1.0 b.p.t :=   endof \ 5.6 6
     .5
  4 of   9.2 b.p.s :=      9.2 b.p.e :=      1.0 b.p.t :=   endof \ 8.5 8
     .6
  endcase
then
wave.type.str " M4" "=
if
  peak.flag
  case
  1 of   3.0 b.p.s :=      3.0 b.p.e :=      1.5 b.p.t :=   endof \ 2.8
  2 of   6.0 b.p.s :=      6.0 b.p.e :=      1.5 b.p.t :=   endof \ 4.4 5
     .6
  3 of   8.6 b.p.s :=      8.6 b.p.e :=      1.5 b.p.t :=   endof \ 5.6 8
     .4
  endcase
then
wave.type.str " W4" "=
if
  peak.flag
  case
  1 of   3.0 b.p.s :=      3.1 b.p.e :=      1.0 b.p.t :=   endof
  2 of   4.8 b.p.s :=      4.8 b.p.e :=      1.0 b.p.t :=   endof
  3 of   6.7 b.p.s :=      6.7 b.p.e :=      1.0 b.p.t :=   endof
  4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
```



```
  endcase
then
wave.type.str " W5" "=
if
  peak.flag
  case
  1 of   2.8 b.p.s :=      2.8 b.p.e :=      1.0 b.p.t :=   endof
  2 of   4.8 b.p.s :=      4.8 b.p.e :=      1.0 b.p.t :=   endof
  3 of   6.7 b.p.s :=      6.7 b.p.e :=      1.0 b.p.t :=   endof
  4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
  endcase
then
wave.type.str " W6" "=
if
  peak.flag
  case
  1 of   2.4 b.p.s :=      2.4 b.p.e :=      1.0 b.p.t :=   endof
  2 of   4.5 b.p.s :=      4.5 b.p.e :=      1.0 b.p.t :=   endof
  3 of   6.7 b.p.s :=      6.7 b.p.e :=      1.0 b.p.t :=   endof
  4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
  endcase
then

bpf.flag 2 =
if
   b.p.s.2  b.p.s :=
   b.p.e.2  b.p.e :=
   b.p.t    b.p.t :=
else
then
; \ ================================================================

"date   " -"  "cat   "time  "cat   d&t.string  ":=
: put.d&t
  normal.coords
  0.80  0.97 position  d&t.string  label
  world.coords
;

: put.spe
  normal.coords
  2.wnd.flag  1 =
  if
    0.17  0.97 position   spe.gen                                label
    \     0.17  0.91 position   spe.hil   spe.bpf  "cat      label
\    0.17  0.91 position   spe.hil                                label
    0.17
    eps.flag 1 =
    if     0.88
    else   0.91
    then         position   spe.hil                              label
  else
    0.17  0.97 position   spe.gen                                label
    0.17  eps.flag 1 = if 0.93 else 0.93 then position   spe.hil
```

```
    spe.bpf.flag  1 =
    if
      spe.bpf  "cat
    then
    label
  then
  world.coords

  int.flag  1 =
  if
      normal.coords
      0.60  0.92   key.orig
      line.#   dup
      \      "spe.str "[ 1 ] "upper " XY"  =
      "spe.str "[ 1 ] "upper "null "=
      if
        f.name.s
      else
        "spe.str "[ line.# ]
      then
      mkl.bat
      key.done
      world.coords
  then
;

: get.spe
  \ !-------------------------
  \  #.wei;band.start.hil,band.stop.hil
  \  "  [25w;2.5,17.5]"
\ \ fixed #.wei
\  pha.or.amp "upper " A" "=
\   pha.or.amp " a" "=
\   if
\     i 1 =
\     if
\       " {HI<="
\       #.wei         0    n>s    "cat  " W}"  "cat
\       band.start.hil  -2    n>s    "cat  " ,"   "cat
\       band.stop.hil   -2    n>s    "cat  " |"   "cat
\     else
\         spe.hil
\         band.start.hil  -2    n>s    "cat  " ,"   "cat
\         band.stop.hil   -2    n>s    "cat  " |"   "cat
\     then
\   else
\     i 1 =
\     if
\       " {HI<="
\       #.wei         0    n>s    "cat  " W}"  "cat
\       band.start.hil  -2    n>s    "cat  " ,"   "cat
\       band.stop.hil   -2    n>s    "cat  " |"   "cat
\     else
\         spe.hil
\         band.start.hil  -2    n>s    "cat  " ,"   "cat
```



```
\         band.stop.hil   -2    n>s    "cat  " |"   "cat
\     then
  pha.or.amp " a" "=
  if
    i 1 =
    if
      " {HI|W-S,E}"
      #.wei            0    n>s    "cat  " -"  "cat
      band.start.hil  -2    n>s    "cat  " ,"   "cat
      band.stop.hil   -2    n>s    "cat  " |"   "cat
    else
        spe.hil
        #.wei            0    n>s    "cat  " -"  "cat
        band.start.hil  -2    n>s    "cat  " ,"   "cat
        band.stop.hil   -2    n>s    "cat  " |"   "cat
    then
  else
    i 1 =
    if
      " {HI|W-S,E}"
      #.wei            0    n>s    "cat  " -"  "cat
      band.start.hil  -2    n>s    "cat  " ,"   "cat
      band.stop.hil   -2    n>s    "cat  " |"   "cat
    else
        spe.hil
        #.wei            0    n>s    "cat  " -"  "cat
        band.start.hil  -2    n>s    "cat  " ,"   "cat
        band.stop.hil   -2    n>s    "cat  " |"   "cat
    then
  \ ---------------------------------------- -
  \  #.wei        0    n>s    "cat  " W}"  "cat
  then
  spe.hil  ":=
     int.flag  1 =
     if
       "null
     else
     " CASE:"      f.name.s                  "cat    "  "  "cat
     then
     " [" "cat
     pt.beg        0    n>s    "cat  " ,"    "cat
     #.fft.pts     0    n>s    "cat  " ]"    "cat
     "  <S:"                                 "cat
     smo.flag      0    n>s    "cat  " ,"    "cat
     " wnd:"                                 "cat
     wnd.str   "upper          "cat  " ,"    "cat
     " F:"                                   "cat
     m.s.freq      0    n>s    "cat  " >"    "cat
  spe.gen  ":=
     \  bandpass[ 2.5 , 3.5 , 1.2 ]        filter
     " {BP:"
     b.p.s        -2    n>s    "cat  " ,"    "cat
     b.p.e        -2    n>s    "cat  " ,"    "cat
     b.p.t        -1    n>s    "cat  " }"    "cat
  spe.bpf ":=
```

```
;                                                                                    431
: call.hil.out
             eps.flag 1 =
             if
               end.gr.out
             else                                                                    436
               hp.new  cdf.now.str   pcx.2 "cat  defer> vup>pcx
             then
;
: call.bpf.out
             eps.flag 1 =                                                            441
             if
               end.gr.out
             else
               hp.new  cdf.now.str   pcx.1 "cat  defer> vup>pcx
             then                                                                    446
;
: call.lab.amp
  \  x.label    "  --- Amplitude Modulation"     "cat
  x.label  \   "  --- Amplitude Modulation"     "cat
  x.label  ":=                                                                       451
  plot.bpf&hil  1 <>
  if
    " Amplitude (cm)"
    y.label  ":=
    label.xy                                                                         456
  else
    " Displacement and Amplitude (cm)"
    y.label  ":=
    label.xy
    eps.flag 1 =  not                                                                461
    if
      hp.new cdf.now.str    pcx.3  "cat  defer> vup>pcx
    then
  then
;                                                                                    466
: call.lab.pha
  \  x.label    "  --- Phase Modulation"     "cat
  x.label  \   "  --- Phase Modulation"     "cat
  x.label  ":=
  " Phase (Radian)"                                                                  471
  y.label  ":=
  label.xy
  eps.flag 1 =  not
  if
  hp.new  cdf.now.str      pcx.3  "cat  defer> vup>pcx                             476
  then
;
: call.lab.fre
\  x.label    "  --- Frequency Modulation for Individual Band"     "cat
  x.label \    "  --- Frequency Modulation for Individual Band"     "cat            481
  x.label  ":=
  " Frequency (Hz)"
  y.label  ":=
  label.xy
```



```
  eps.flag 1 =  not                                                                  486
  if
    hp.new cdf.now.str      pcx.3  "cat  defer> vup>pcx
  then
;
\                                                                                    491
  ------------------------------------------------------------------------

: get.log.min
  dup  0.  >
  if
  11.  v.min :=
  begin                                                                              496
  dup
  v.min   1 -  v.min  :=
  10.  v.min  **    swap /     1.   <
  until
  10. v.min  **    v.min    :=                                                      501
  drop
  else
     v.min :=
  then
;                                                                                    506

: get.x.v.res
  swap
       dup  []min/max   x.v.max   :=   get.log.min  v.min  x.v.min  :=
  swap                                                                               511
       dup  []min/max   y.v.max   :=   get.log.min  v.min  y.v.min  :=
;
: get.x.v
  swap
       dup  []min/max   x.v.max   :=                                               516
       x.axis.flag  " o"  "=
       if   get.log.min  v.min
       then
       x.v.min  :=
  swap                                                                               521
       dup  []min/max   y.v.max   :=
       y.axis.flag  " o"  "=
       if   get.log.min  v.min
       then
       y.v.min  :=                                                                 526
;
: change.w.s.bpf.t
    \ get.x.v
    horizontal
       x.v.min    x.v.max     world.set                                            531
    vertical
       axis.fit.off
       -1.2       0       5   label.format
       -0.125     0.125       world.set
;                                                                                    536
: change.w.s.bpf.f
    horizontal
```

```
       \ x.v.min     x.v.max      world.set
       0.             10.      world.set
    vertical                                                    541
       axis.fit.off
       -1.2        0        5    label.format
    \  y.v.min     y.v.max      world.set
       0.00        1.25         world.set
;                                                               546
: change.w.s.hil.t
    horizontal
       x.v.min     x.v.max      world.set
    vertical
       axis.fit.off                                             551
       -1.2        0        5    label.format
       -1.00       1.00         world.set
;
: change.w.s.hil.f
    horizontal                                                  556
        \ x.v.min     x.v.max      world.set
        0.00        x.v.max      world.set
    vertical
       axis.fit.off
       -1.2        0        5    label.format                  561
    \  y.v.min     y.v.max      world.set
       0.00        1.25         world.set
;
: set.w.s.x
    horizontal                                                  566
        axis.fit.off
        x.axis.flag   " o"   "=
        if
          x.v.min     x.v.max      world.set
        else                                                    571
          x.beg       x.end        world.set
        then
;
: change.w.s.amp
  set.w.s.x                                                     576
;
: change.w.s.amp.y
    vertical
     channel.#     2   <=
     if                                                         581
       -1.2        0        5    label.format
       b.p.flag   0   =
       if
          -2.0        2.0          world.set
       else                                                     586
          -10.        10.          world.set
       then
    else
       -1.2        0        5    label.format
       b.p.flag   0   =                                         591
       if
          -2.0        2.0          world.set
```



```
       else
          -1.0        1.0          world.set
       then                                                     596
    then
    \  0.00        1.25         world.set
;
: change.w.s.fre   \ for frequency modulation
  set.w.s.x                                                     601
    vertical
\      axis.fit.off
       -1.2        0        5    label.format
       0.0         10.          world.set
;                                                               606
: change.world.set.ps
  channel.#     2   <=
  if
    horizontal
       x.v.min     x.v.max      world.set                      611
\      0.2         x.v.max      world.set
    vertical
      -1.2         0        7    label.format
\      y.v.min     y.v.max      world.set
       yfix.flag 1 =                                            616
       if
         y.axis.flag   " o"   "=
         if
           10. -4. ** 10. 2. **    world.set
         else                                                   621
         \  0           15.          world.set
           0           10.          world.set
         then
       else
          y.v.min     y.v.max      world.set                   626
       then
  else      \ ch.3 4 5
    horizontal
       x.v.min     x.v.max      world.set
\      0.2         x.v.max      world.set                      631
    vertical
      -1.2         0        7    label.format
       yfix.flag 1 =
       if
         y.axis.flag " o"   "=                                  636
         if
           10. -5. ** 10.  1. **   world.set
         else
           axis.fit.off
          -1.2         0        4    label.format              641
           0.          0.25         world.set
         then
       else
          y.v.min     y.v.max      world.set
       then                                                     646
  then
;
```

```
\
   ------------------------------------------------------------------------


: get.p.inc  \ reset s.freq                                              651
  b.p.flag  1 <>
  if    0  b.p.s :=    0  b.p.e :=   0  b.p.t :=  then
  m.s.freq.flag  1 =
  if
    s.freq.ori   m.s.freq  /  p.inc :=                                   656
    s.freq.ori   p.inc  float /
    s.freq :=
  else
    1 p.inc :=
  then                                                                   661
;
: get.smo
  smo.flag 1 =
  if  smooth  then
;                                                                        666
: plot.hil.Re&Im
  hit.t  fft
  SUB[ 1 , #.FFT.PTS  #.frac / ]
  dup
\ %%  zreal up                                                           671
  zreal up.new
  1 yap
\ %%  zimag dp
  zimag dp.new
  2 ydp  my.pause                                                        676
;

\ ====================================================================
\ There are very strange behavior of x.label here.
\ x.label behaviors differently when get.x.time and get.x.freq are not   681
   placed
\ in this file (i.e., placed in Get-X-N.asy)
\
   ------------------------------------------------------------------------

: get.x.time
  []size  ramp
  x.axis.flag  " l"  "=                                                  686
  if
    1.  -
  then
  x.conv.flag   1  =
  \  " Point"   x.label  ":=                                             691
  if
    " Time (sec)"   x.label  ":=
    float      s.freq  /   becomes> x.time
    x.time
  else                                                                   696
    " Point"   x.label  ":=
  then
```



```
  \ x.label s.type
  \ x.label " <---GotT--- " "cat get.str "drop
  swap                                                                   701
  \ ---------------------------------------- -
  atoa.flag   1  =
  if
  2  pick      2  pick
  #.xy  1 +   #.xy  :=                                                   706
  then
;
: get.x.freq     \ chech get-x-n ? (08-01-97)
  []size  ramp   \ 1.  -
  \  " Point"   x.label  ":=                                             711
  x.conv.flag   1  =
  if
    " Frequency (Hz)"   x.label  ":=
    float    s.freq  float  *  #.fft.pts  float  /  becomes> x.freq
    x.freq                                                               716
    \ " Frequency (Hz)"   x.label  ":=
  else
    " Point"   x.label  ":=
  then
  \ x.label s.type                                                       721
  \ x.label " <---GotF--- " "cat get.str "drop
  swap
  atoa.flag   1  =
  if
  2  pick      2  pick                                                   726
  #.xy  1 +   #.xy  :=
  then
;
\
   ------------------------------------------------------------------------


: plot.bpf   \ [ array - ]                                               731
  plot.bpf&hil  1 <>
  if
    drop  exit
  then
            eps.flag 1 =                                                 736
            if
              cdf.now.str " BPF-FIR.eps"  "cat "dup  ps.file.name ":=
              defer> ps.file
              ini.gr.out
              ps.hp ps.up  ps.dp                                         741
            else  gd  hp
            then
  \ %% gd hp
  \ %% up
  hp.new                                                                 746
  up.new
    0  x.conv.flag :=
    1  x.conv.flag :=
    \ cr x.label s.type.2 \ strange behavior of x.label here
    get.x.time                                                           751
```

```
    \ x.label s.type.2
    \ x.label get.str "drop
    get.x.v
    xy.data.fit
    change.w.s.bpf.t                                                    756
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    2  xydp
    put.spe                                                             761
    put.d&t
    x.label "  --- Bandpass Filter in Time Domain" "cat
    \      " Point --- Bandpass Filter in Time Domain"
     " Response"  0.02 labxy.stack
  \ %%  dp                                                              766
  dp.new
     #.fft.pts  #.wei -  real  ramp  becomes>  tmp.t
     0.  tmp.t  :=
     tmp.t  filter.fir  catenate
     #.fft.pts  #.wei -  2 / rotate                                     771
     becomes> tmp.t      \ zero padded filter response

     tmp.t fft zmag      \ FIR in Frequency domain
     becomes> bpf.t
     bpf.t   SUB[ 1 , #.FFT.PTS  #.frac /  5 / ]                       776
     1  x.conv.flag :=
     get.x.freq
     get.x.v
     xy.data.fit
     change.w.s.bpf.f                                                  781
     \ get.fit.axis
     xy.axis.plot
     put.grid.lines
     4  xydp
     x.label "  --- Bandpass Filter in Frequency Domain" "cat          786
     \      " Point --- Bandpass Filter in Frequency Domain"
     " Window"  0.02 labxy.stack
     call.bpf.out
     \ solid outline     \ %% strange behavior (may be due to abnormal
        stop?)
  eps.flag 1 = if  else my.pause then                                   791
;
\
   ------------------------------------------------------------------------

: plot.hil.FIR   \ [ array - ]
  plot.bpf&hil  1 <>
  if                                                                    796
    drop  exit
  then
            eps.flag 1 =
            if
              cdf.now.str " Hil-FIR.eps"  "cat  "dup  ps.file.name ":=  801
              defer> ps.file
              ini.gr.out
```



```
              ps.hp ps.up  ps.dp
            else  gd  hp
            then                                                        806
  hp.new
  up.new
    0  x.conv.flag :=
    1  x.conv.flag :=
    \ cr  x.label s.type.2 \ strange behavior of x.label here          811
    get.x.time
    \ x.label s.type.2
    \ x.label get.str "drop \ for test
    get.x.v
    xy.data.fit                                                         816
    change.w.s.hil.t
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    2  xydp                                                             821
    put.spe
    put.d&t
    x.label "  --- Hilbert FIR in Time Domain" "cat
    \      " Point --- Hilbert FIR in Time Domain"
    " Response"  0.02 labxy.stack                                       826
    \ solid outline
  dp.new
    #.fft.pts  #.wei -  real  ramp  becomes>  tmp.t
    0.  tmp.t  :=
    tmp.t  filter.fir  catenate                                         831
    #.fft.pts  #.wei -  2 / rotate
    becomes> tmp.t      \ zero padded filter response
    tmp.t fft zmag      \ FIR in Frequency domain
    #.fft.pts 2 / rotate
    \ #.fft.pts 4 /  neg rotate                                         836
    SUB[ 1 , #.FFT.PTS  #.frac /  2 / ]
    1  x.conv.flag :=
    get.x.freq
    get.x.v
    xy.data.fit                                                         841
    change.w.s.hil.f
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    4  xydp                                                             846
    x.label "  --- Hilbert FIR in Frequency Domain" "cat
    \ " Point --- Hilbert FIR in Frequency Domain"
    " Window"  0.02 labxy.stack
    call.hil.out
  eps.flag 1 = if  else my.pause then                                   851
;
\ ================================================================
: make.wks.1   \ for col.beg=0, [ x, y, " 123.f.n" - x, y ]
               \ for col.beg>0, [    y, " 123.f.n" - y ]
  cr                                                                    856
          col.beg  0  =  \ x axis
          if
```

```
            col.beg  1 +  col.beg :=
            x.label             " $" "cat  123.ary.s0 "[ 1 ]  ":=
            y.label             " $" "cat  123.ary.s0 "[ 2 ]  ":=
            f.name.s            " $" "cat  123.ary.s0 "[ 3 ]  ":=
            spe.gen             " $" "cat  123.ary.s0 "[ 4 ]  ":=
            mod.flag " p" "= if  " Fre-M" then
            mod.flag " a" "= if  " Amp-M" then
            " !" "cat
            d&t.string  "cat    " $" "cat  123.ary.s0 "[ 5 ]  ":=

            2  pick
              123.file.name.1   row.beg  col.beg      " d"
                 ato123.bat.new
          then

          col.beg  1 +  col.beg :=
          f.name.s          " -B"  "cat  peak.flag  0 n>s  "cat
                      " $" "cat  123.ary.s "[ 1 ]  ":=
          spe.bpf             " $" "cat  123.ary.s "[ 2 ]  ":=
          spe.hil             " $" "cat  123.ary.s "[ 3 ]  ":=
          spe.gen             " $" "cat  123.ary.s "[ 4 ]  ":=
          " ---"              " $" "cat  123.ary.s "[ 5 ]  ":=
          dup
             123.file.name.1   row.beg  col.beg       " d"
                ato123.bat.new
;
: make.wks.2   \ for col.beg=0, [ x, y, " 123.f.n" - x, y ]
               \ for col.beg>0, [    y, " 123.f.n" - y ]
  cr
          col.beg.2  0  =  \ x axis
          if
            col.beg.2  1 +  col.beg.2 :=
            x.label             " $" "cat  123.ary.s0 "[ 1 ]  ":=
            y.label             " $" "cat  123.ary.s0 "[ 2 ]  ":=
            f.name.s            " $" "cat  123.ary.s0 "[ 3 ]  ":=
            spe.gen             " $" "cat  123.ary.s0 "[ 4 ]  ":=
            mod.flag " p" "= if  " Fre-M" then
            mod.flag " a" "= if  " Env-M" then
            " !" "cat
            d&t.string  "cat    " $" "cat  123.ary.s0 "[ 5 ]  ":=
            0.  123.ary.n0  :=

            2  pick
              123.file.name.2   row.beg.2  col.beg.2    " d"
                 ato123.bat.new
          then

          col.beg.2  1 +  col.beg.2 :=
          f.name.s          " -B" "cat  peak.flag  0 n>s  "cat
                              " $" "cat  123.ary.s "[ 1 ]  ":=
          spe.bpf             " $" "cat  123.ary.s "[ 2 ]  ":=
          spe.hil             " $" "cat  123.ary.s "[ 3 ]  ":=
          spe.gen             " $" "cat  123.ary.s "[ 4 ]  ":=
          " ---"              " $" "cat  123.ary.s "[ 5 ]  ":=
          dup
```



```
                123.file.name.2   row.beg.2  col.beg.2    " d"
                   ato123.bat.new
;

: pha&fre.mod
  rad
  1  set.order
  2  set.degree

  ori.t                        becomes> x.t
  hil.flag  0  =
  if
    x.t    hilbert  neg    \  Edge effects
  else
    qua.t           neg    \  Sinuzoidal effects (Use Minimax)
  then
                               becomes> y.t
  x.t  y.t  z=x+iy             becomes> z.t

  \ ----- Plot ori & qua & envelope
  \  gd hp   x.t       sub[ 1 , #.fft.pts  #.frac / #.frac.2 /  ]  1 yap
  \          y.t       sub[ 1 , #.fft.pts  #.frac / #.frac.2 /  ]  2 ydp
  \          z.t zmag  sub[ 1 , #.fft.pts  #.frac / #.frac.2 /  ]  3 ydp
  \  my.pause

  \ ----- Carrier
  real  #.fft.pts  ramp                  \ total points
  b.p.s  b.p.e +   2. /  s.freq  /       \ cycle per point
  2.    pi *                             \ radian per point
  *     *                                \ phase of each point
  dup   cos    swap
        sin
  z=x+iy            becomes> c.t         \ carrier

\   \ ---------------------------------------- -
\   \ Without carrier
\   1 0
\   z=x+iy            becomes> c.t         \ carrier
\   \ ---------------------------------------- -

\   c.t   z.t [ 1 ] *    z.t [ 1 ] zmag /         \ commented 042097
\                      becomes> c.t         \ set initial phase to equal
\ commented 042097

  z.t  c.t  /  becomes> z.t  \ added 042097

  \ z.t  c.t *        becomes> a.t
  \ ----- Phase difference
  \ z.t   zarg  c.t  zarg  -   becomes> pha.t          \ bad method
  \ z.t         c.t        /    zarg   becomes> pha.t    \ good
  \ Wrong method
  z.t                          zarg   becomes> pha.t    \ good
  pha.t                        differentiate.data
  2. pi  *  /
  s.freq *
```

```
  becomes> fre2.t  \ this yields bad results due to direct numerical
     differentiation
\ z.t                        differentiate.data    zarg                  966
\ z.t          c.t        /    differentiate.data    zarg
  \ Calcute dp/dt  --- use polar z=r*exp(i p)
  z.t  differentiate.data                                  \ dz
  z.t  zmag   differentiate.data                           \ dr
  z.t  zarg   dup   cos   swap   sin  z=x+iy  *            \ exp(i p) * dr    971
  -                                                        \ --> numerator
  z.t    0 1 z=x+iy  *                                     \ i * z -->
     denomenator
  /

  2. pi *   /      s.freq *        \ change unit from radian to            976
     frequency
  \ zmag                                                   \ Wrong
  zreal                                                    \ Yes
  \ ---------------------------------------- -
  \ Without carrier
  \ 0                      +                                                981
  \ ---------------------------------------- -
  \ With carrier
    b.p.s  b.p.e +   2. /  +  \ added 042097
  \ ---------------------------------------- -
  becomes> fre.t                                           986

  \ 0  1  =  \  = -> Show ; <> -> no show
  \ 1  1  =  \  = -> Show ; <> -> no show
  1  showflag =
  if                                                       991
    eps.flag 1 =  not
    if gd
    then
    hp.new
    z.t   zarg                                             996
           sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
           1 yap
    c.t   zarg
           sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
           2 ydp                                           1001
    rad
    my.pause
    eps.flag 1 =  not
    if gd
    then                                                   1006
    up.new
    pha.t
           sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
           1  x.conv.flag :=
           get.x.Time                                      1011
           take.part
           get.x.v
   \ cr  ." 0---"  x.v.min .  x.v.max
   \ " TEST" get.str "drop
           xy.data.fit                                     1016
```



```
           \          change.w.s.amp
           xy.axis.plot
           put.grid.lines
           line.#      xydp
           put.d&t     put.spe                             1021
           call.lab.pha
    dp.new
    fre2.t
           sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
           get.x.Time                                      1026
           take.part
           get.x.v
           xy.data.fit
           \          change.w.s.amp
           xy.axis.plot                                    1031
           put.grid.lines
           line.#      xydp
           put.d&t     put.spe
           call.lab.fre
  then                                                     1036
  \ ------------------------------------------------
  \ gd    \ to allow overlap
  eps.flag 1 = not
  line.#   1 =        and
  if                                                       1041
    gd hp
  then
  hp.new
  fre.t
           sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]       1046
           get.x.Time
           take.part
           get.x.v
           x.v.min  n.type  x.v.max .
           \ cr  ." 2---"  x.v.min .  x.v.max  .    ."  2"  2  get.val   1051
              drop

           " Frequency (Hz)"  y.label ":=
           0.  123.ary.n  :=
           make.wks.1
                                                           1056
           xy.data.fit

           change.w.s.fre
           xy.axis.plot
           put.grid.lines                                  1061

           line.#      xydp                    \ added 04-11-97
   \       2  *drop                            \ ----   when out of
      vuport
           put.d&t     put.spe
           call.lab.fre                                    1066
           \          2 xydp

;
```

```
: find.neg.pos                                                    1071
  env.t  \ smooth
  differentiate.data
  ord.flag  2 =
  if
    differentiate.data                                            1076
  then
  sort
  becomes> t1
  0 tmp.v.i  :=
  begin                                                           1081
    tmp.v.i  1 +  tmp.v.i  :=
    t1 [ tmp.v.i ]  0  >=
  until
  tmp.v.i  #.neg  :=
\  begin                                                          1086
\    tmp.v.i  1 +  tmp.v.i  :=
\    t1 [ tmp.v.i ]  0  >
\  until
\  tmp.v.i  #.pos  :=
\  env.t  []size swap drop  #.pos  -  1 +  #.pos  :=             1091
\  t1  mean
  t1  []size swap drop  tmp.v.i.2  :=
  tmp.v.i.2  #.neg -  #.pos  :=
  t1  mean
  ord.flag 2 =                                                    1096
  if
    s.freq float 2 **  *
  else
    s.freq float *
  then                                                            1101
    mean.slope  :=
;
: gen.h.t  \
  cr ." [1:Color, 2:file, 3:chan, 4:fft.pts, 5:m.s.r, 6:#.FIR 7:start
     -- ]"
  band.start.hil :=                                               1106
  #.wei  :=
  m.s.freq  :=
  #.fft.pts  :=
  channel.#  :=
  line.#  :=                                                      1111
  "dup
  " ."  "cat
  channel.#  \ 96
\  48  +  ascii"  "cat
  cr  b.p.s . b.p.e n.type                                        1116

  0 n>s  "cat
  "dup  f.name.s  ":=
  cda.str  "swap  "cat  cr  "dup  s.type
  defer>  file.open                                               1121
  2 subfile  file>unnamed.array  file.close
  dir.lee.dat  "swap  "cat  " .dat"  "cat  cr  "dup  s.type
```



```
  defer>  file.open
  1 subfile  file>unnamed.array  [ 3 ] s.freq :=  file.close
  \ parameter.1  parameter.2                                      1126

  get.p.inc  \ reset s.freq = m.s.freq
  \ ---------------------------------------- -
  \ \ s.freq  2. /  band.start.hil -  band.stop.hil :=
  \ ---------------------------------------- -                   1131
  \ set.bpf.hil
  \ ---------------------------------------- -
  get.spe
  get.smo
  \  sub[ 1 , #.fft.pts , p.inc ]                                1136
  sub[ pt.beg , #.fft.pts , p.inc ]

  wnd.str  "upper " X"  "=  if                          then
  wnd.str  "upper " K"  "=  if  blackman.window.apply   then
  wnd.str  "upper " B"  "=  if  bartlett.window.apply   then      1141
  wnd.str  "upper " N"  "=  if  hanning.window.apply    then
  wnd.str  "upper " M"  "=  if  hamming.window.apply    then
  \ blackman.window.apply  \ added fot test
  \  \  ." >>>"  my.pause
                                                                  1146
\ ------------------------------------
   s.freq  filter.sample.rate
   b.p.flag  1 =
   if
     \  sd                                                        1151
     \  bandpass[ 2.5 , 3.5 , 1.2 ]
     bandpass[ b.p.s , b.p.e , b.p.t ]  filter
     filter.fir  becomes>  bpt.t
     bpt.t  plot.bpf
   then                                                           1156
  \ ------------------------------------
  1 *  \ Very important to prevent numerical underflow
  becomes> ori.t
  hilbert[ #.wei ; band.start.hil , band.stop.hil ]
  \  sd                                                          1161
  cr  #.wei .  10  4  fix.format
  plot.bpf&hil  1 =
  if
    cr band.start.hil . cr band.stop.hil .  cr  n.type  \  MY.PAUSE
  then                                                           1166

  filter.fir  becomes> hit.t  \ FIR in Time domain

  \ plot.hil.Re&Im
  hit.t  plot.Hil.FIR                                            1171

  plot.bpf&hil  1 =
  if
\             eps.flag 1 =
\             if                                                1176
\               cdf.now.str " 03.eps"  "cat "dup  ps.file.name ":=
\               defer> ps.file
```

```
\                 ini.gr.out
\                 ps.hp ps.up  ps.dp
\               else  gd  hp
\               then
    exit
  then

  hil.flag 1 =
  if
    ori.t  filter      becomes> qua.t    \ use minimax Filter mentod
  else
    ori.t  hilbert     becomes> qua.t
  then
  \ ----- Amplitude modulation
  qua.t  2. **  ori.t 2. **  +  SQRT

\  0.2 set.cutoff.freq
\  smooth

  BECOMES> env.t

  plot.bpf&hil  1  =
  if
    eps.flag 1 =  not
    if gd
    then
\ %%    gd
\ %%    hp
    hp.new
  then
  mod.flag  " a"   "=
  if
\ %%    ini.gr.out
    \ ori.t  SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
    ori.t  SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
           1  x.conv.flag :=
           get.x.Time
           take.part
           get.x.v
           " Amplitude (cm)"  y.label  ":=
    2in1.flag 1 =
    if
           line.#  1 =
           if
             eps.flag 1 =
             if
               ini.gr.out
               ps.hp ps.up  ps.dp
             else  gd  hp
             then
             up.new
             xy.data.fit

             xy.axis.plot
             put.grid.lines
```



```
           then
           line.#  3 =
           if
             dp.new
             xy.data.fit
             change.w.s.amp
             xy.axis.plot
             put.grid.lines
           then
           0.  123.ary.n  :=
           make.wks.1
           \ get.fit.axis

           line.#
           case
             2   of  up.new  endof
             4   of  dp.new  endof
             5   of  dp.new  endof
           endcase
    else
       ini.gr.out
           eps.flag 1 = not
           if  gd  hp
           else  ps.hp ps.up  ps.dp
           then
           hp.new
           xy.data.fit
           change.w.s.amp
           xy.axis.plot
           put.grid.lines
           0.  123.ary.n  :=
           make.wks.1
    then
           2in1.flag  1 =
           \ eps.flag 1 =
           if
             line.#
           else
             1
           then
           xydp
           put.d&t    put.spe

\ ======================================== -
\ The following two "xydp" both plot the envelope curves.
\ env.t is based on hil.flag (minimax or not).
  env.t  SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
           get.x.Time
           take.part
           " Amplitude (cm)"  y.label  ":=
           find.neg.pos
           0.      123.ary.n :=
           #.pos float #.fft.pts float /
                 dup p.pos [ line.# ] :=  123.ary.n [ 1 ] :=
           #.neg float #.fft.pts float /
```

```
                dup p.neg [ line.# ] :=  123.ary.n [ 2 ] :=
          mean.slope
                dup m.slo [ line.# ] :=  123.ary.n [ 3 ] :=
          make.wks.2
          2 xYDP
  \ ---------------------------------------- -
    ori.t  hilbert
    2. **  ori.t 2. **  +  SQRT
          get.x.Time
          take.part
    1 xydp
  \ ======================================== -

      normal.coords
\      line.#  2 <=
\      if
         0.60  0.90   key.orig
\          0.60  0.92   key.orig
\      else
\          0.65  1.10   key.orig
\      then
       line.#   dup
       line.#  2 <=
       if
         2in1.flag 1 =
         if
           line.# 1 -  -
         then
       else
         2in1.flag 1 =
         if
           2 -  \ raise 2 lines
         else
           line.# 1 -  -
         then
       then
       " Band:"  line.#   0 n>s  "cat
       "  [ " "cat    b.p.s  3  n>s  "cat
       "  ]" "cat
       \ "  [" "cat    #.pos float #.fft.pts float / -3 n>s "cat
       \ " ," "cat     #.neg float #.fft.pts float / -3 n>s "cat  " ]"
          "cat
       mkl.bat
       key.done
       world.coords
     plot.bpf&hil  1  =
     if
       ori.t  envelope
            SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
            get.x.Time
            take.part
            3 xYDP
     then
     call.lab.amp
```



```
     2in1.flag 1 =
     if
     else
       end.gr.out
     then
   else
     \ my.pause
     \ gd
\ %%    hp
     hp.new
     pha&fre.mod
   then
;

: gen.mod      \
   eps.flag  1  =
   if
\    sd
     ibm.graphics     \ device.init  \ Don't use init
     def.vuport
   else
     \
   then

   cr ." [1:Color, 2:file, 3:chan, 4:peak, 5:mode -- ]"
   mod.flag  ":=
   peak.flag  :=
   channel.#  :=
   tmp.s      ":=
   line.#     :=
   tmp.s  n.str1      ":=

   pha.or.amp  " a"  "=
   if
\    n.str1  7 "left   channel.#  0 n>s  "cat  " .a" "cat
\    peak.flag 0  n>s "cat
\    "dup  cdf.now.str  "swap "cat  ps.file.name ":=
\    file.name.ary "[ 7 ]  ":=
     n.str1  " .a" "cat channel.#  0 n>s  "cat
     peak.flag 0  n>s "cat
     "dup  cdf.now.str  "swap "cat  ps.file.name ":=
     file.name.ary "[ 7 ]  ":=
   then

   set.bpf
\  0  plot.bpf&hil  :=
   1  #.frac.2 :=

   line.#  tmp.s channel.# #.fft.pts  m.s.freq  #.wei  band.start.hil
      gen.h.t
   drop  \ still, there is unsolved garbage on stack
;

\
  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

```
\ 1  " a0m1020"  channel.#  #.fft.pts  m.s.freq  #.wei  band.start.hil
   gen.h.t
\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
\
   --------------------------------------------------------------------------

integer  scalar c.num1

\ dir.lee.txt  " test-hil.txt"  defer>  load

\ ================================================================
\ ================================================================
0  spe.bpf.flag :=
integer scalar graph.#
cdtNow load take-f-n.asy \
: ptof.bat.new   \ [ " file.ext" - ]
  eps.flag 1 =   not
  if
\ %%  hp  cdf.now.str  "swap  "cat  defer>  vup>pcx
    hp.new  cdf.now.str  "swap  "cat  defer>  vup>pcx
  then
;

: ato123.bat.ini.bat.all  \ ini 123.file.name.1 & 2
  n.str1  4  "left
  n.str1  6  "left  1 "right   "cat
  c.num1 0 n>s  "cat

  pha.or.amp  " p"  "=
  if
          " f.wks" "cat  ato123.bat.ini.bat.1
  else
    "dup  " a.wks" "cat  ato123.bat.ini.bat.1
          " e.wks" "cat  ato123.bat.ini.bat.2
  then

;

real dim[ 6 ] array sum.p.pos
     dim[ 6 ] array sum.p.neg
     dim[ 6 ] array sum.m.slo
real dim[ 6 , 30 ] array p.pos.2d
     dim[ 6 , 30 ] array p.neg.2d
     dim[ 6 , 30 ] array m.slo.2d
1  integer scalar #.graph
  0. sum.p.pos :=
  0. sum.p.neg :=
  0. sum.m.slo :=
```



```
: do.sum \ Summation for multi-segment, graph.#: segment
  line.# 1 +  1   \ Line.# and i: band
  do
    sum.p.pos [ i ]  p.pos [ i ]  +  sum.p.pos [ i ] :=
    sum.p.neg [ i ]  p.neg [ i ]  +  sum.p.neg [ i ] :=
    sum.m.slo [ i ]  m.slo [ i ]  +  sum.m.slo [ i ] :=

    p.pos [ i ]  p.pos.2d [ i ,    graph.#  1 - #.graph -  ] :=
    p.neg [ i ]  p.neg.2d [ i ,    graph.#  1 - #.graph -  ] :=
    m.slo [ i ]  m.slo.2d [ i ,    graph.#  1 - #.graph -  ] :=
  loop
;

: loop.gen.mod
  "dup
      take.f.n.p1.s  n.str1  ":=
      take.f.n.p2.n  c.num1   :=

  n.str1 "upper n.str1 ":=
  n.str1 4 "left 2 "right wave.type.str ":=

  ato123.bat.ini.bat.all
  0     col.beg   :=
  1     row.beg   :=
  0     col.beg.2  :=
  1     row.beg.2  :=

  plot.bpf&hil  1 =
  if
    1
  else
    wave.type.str " M1" "= if 5 then
    wave.type.str " M2" "= if 4 then
    wave.type.str " M3" "= if 4 then
    wave.type.str " M4" "= if 3 then
    wave.type.str " W4" "= if 4 then
    wave.type.str " W5" "= if 4 then
    wave.type.str " W6" "= if 4 then
  then
  1 +   1
  do \ channel: c.num1, band: i
    i    n.str1  c.num1      i   pha.or.amp    gen.mod
  loop
  eps.flag  1 =  not
  if
    gp.name
    graph.# 0 n>s  "cat  " .pcx"  "cat   ptof.bat.new
    \ graph.# 0 n>s   " .pcx"  "cat   ptof.bat.new
  then
  graph.# 1 +  graph.#  :=

  \  pha.or.amp "upper  " A"  "=
  pha.or.amp   " a"  "=
  if
    do.sum
```

```
  then
  \  my.pause
;
                                                                    1501
: get.s.freq.ori
  "dup
  " ." "swap "within ?drop 1 - "left " .dat" "cat
  "dup tmp.s ":=
  dir.lee.dat "swap "cat defer> file.open                           1506
  1 subfile file>unnamed.array [ 3 ] s.freq :=  file.close
  s.freq s.freq.ori :=
  m.s.freq.flag 1 =
  if
  else                                                              1511
    s.freq m.s.freq :=
  then
  \ ======================================== -
  x.beg  0 >
  if                                                                1516
  else
    0.  x.beg :=
  then
  \ ---------------------------------------- -
  x.end                                                             1521
  #.fft.pts 1 - float   m.s.freq float  /
  <
  if
  else
    #.fft.pts 1 - float   m.s.freq float  /                          1526
    x.end :=
  then
;
\ ================================================================
: lgm                                                               1531
 loop.gen.mod
;
1 graph.#  :=
: set.mod.reset
  get.p.inc                                                         1536
  7 2      fix.format
   3  2  goto.xy  ." x.beg (Plot range)" x.beg get.val x.beg :=
   3  3  goto.xy  ." x.end (Plot range)" x.end get.val x.end :=
\    40 2  goto.xy  ." pt.beg (Input data range)" pt.beg get.val pt.beg
   :=
  4 0      fix.format                                               1541
   3  4  goto.xy  ." hil.flag (Minimax flag)" hil.flag get.val hil.flag
      :=
   40 4  goto.xy  ." #.wei" #.wei get.val #.wei :=
   3  5  goto.xy  ." #.fft.pts" #.fft.pts get.val #.fft.pts :=
   40 5  goto.xy  ." pt.beg (Data range)" pt.beg get.val pt.beg :=
   \ 67 5  goto.xy  ." smo.flag" smo.flag get.val smo.flag :=       1546
   3  6  goto.xy  ." smo.flag" smo.flag get.val smo.flag :=
   40 6  goto.xy  ." Window (x,k,b,n,m):" wnd.str   get.str  wnd.str
         ":=
   3  7  goto.xy  ." s.freq (Modified)" m.s.freq get.val m.s.freq :=
```



```
   40 7  goto.xy  ." s.freq (Ori)" s.freq.ori get.val s.freq.ori :=
   56 7  goto.xy  ." (" tmp.s s.type.2 ." )"                        1551
   70 7  goto.xy  ." p.inc" p.inc get.val p.inc :=

   3  8  goto.xy  ." Fre(p) or Amp(a):" pha.or.amp  get.str  pha.or.amp
      ":=
   3  10 goto.xy  ." Initial plot number:" graph.#  get.val  graph.#
        :=
   \  1  ord.flag  :=  \ \\ this is system default value             1556
   3  11 goto.xy  ." Set derivative order: (for amp slope)"
              ord.flag get.val ord.flag    :=
   3  12 goto.xy  ." Example:"  " '' f1w6020.1''  loop.gen.mod (lgm)"
      s.type
   2  14 goto.xy   " Press F-key to reenter" s.type.2
  pckey  drop if myself then                                        1561
;
: set.mod
  get.p.inc
  sc
  \ \  {show.wnd.s} {border}                                        1566
  bg.color   background
  14         foreground
  \ sd
  sc
  {border}                                                          1571
  7 2      fix.format
   3  2  goto.xy  ." x.beg (Plot range)" x.beg n.type
   3  3  goto.xy  ." x.end (Plot range)" x.end n.type
  4 0      fix.format
   3  4  goto.xy  ." hil.flag (Minimax flag)" hil.flag n.type       1576
   40 4  goto.xy  ." #.wei" #.wei n.type
   3  5  goto.xy  ." #.fft.pts" #.fft.pts n.type
   40 5  goto.xy  ." pt.beg (Data range)" pt.beg n.type
   \ 67 5  goto.xy  ." smo.flag" smo.flag n.type
   3  6  goto.xy  ." smo.flag" smo.flag n.type                      1581
   40 6  goto.xy  ." Window (x,k,b,n,m):" wnd.str   s.type
   3  7  goto.xy  ." s.freq (Modified)" m.s.freq n.type
   40 7  goto.xy  ." s.freq (Ori)" s.freq.ori n.type
   56 7  goto.xy  ." (" tmp.s s.type.2 ." )"
   70 7  goto.xy  ." p.inc" p.inc n.type                           1586

   3  8  goto.xy  ." Fre(p) or Amp(a):" pha.or.amp  s.type
  4 0      fix.format
   3  10 goto.xy  ." Initial plot number:" graph.#  n.type
   \  1  ord.flag  :=  \ \\ this is system default value             1591
   3  11 goto.xy  ." Set derivative order: (for amp slope)"  ord.flag
      n.type
   3  12 goto.xy  ." Example:"  " '' f1w6020.1''  loop.gen.mod (lgm)"
      s.type
   2  14 goto.xy   " Press F-key to reenter" s.type.2
  non.stop.flag 1 =
  if                                                                1596
    exit
  then
  pckey  drop
```

```
  if
    set.mod.reset                                                    1601
  then
  get.p.inc
;
\ ================================================================
: do.fm.bat                                                          1606
  \ get.s.freq.ori
  set.lc
  " p"  pha.or.amp  ":=
  file.name.ary "[ 7 ]  ":=
  \ " b0w4020.4"   file.name.ary "[ 7 ]  ":=                         1611
  ibm.graphics    \ device.init  \ Don't use init
  def.vuport
  ato123.bat.ini.bat.all
  int.flag 1 =
  if                                                                 1616
  else
\     cr cr cda.str
      cr cr cdf.now.str
      file.name.ary "[ 7 ]  7 "left   "cat  " .f" "cat
      file.name.ary "[ 7 ]  "len  "drop                              1621
      " ."    file.name.ary "[ 7 ]  "within    if then
      swap  -
      file.name.ary "[ 7 ]   "right   "cat
      "dup  ps.file.name  ":=
      defer> ps.file                                                 1626
  then

  ini.gr.out
  \  " b0w4020.4"  lgm
  file.name.ary "[ 7 ]   lgm                                         1631
  end.gr.out
  ibm.graphics  \ %
  def.vuport
;
: do.am.bat                                                          1636
  \ get.s.freq.ori
  set.lc
  " a"  pha.or.amp  ":=
  file.name.ary "[ 7 ]  ":=
  ato123.bat.ini.bat.all                                             1641
  \  0 int.flag :=
  \  0 eps.flag :=
  \  0 2in1.flag :=
  file.name.ary "[ 7 ]   lgm
  \  " b0w4020.4"  lgm                                              1646
  ibm.graphics  \ %
  def.vuport
;
: do.am.fm.bat
  \ pha.or.amp "upper " A" "=                                        1651
  pha.or.amp " a" "=
  if do.am.bat then
  \ pha.or.amp "upper " P" "=
```



```
  pha.or.amp " p" "=
  if do.fm.bat then                                                  1656
;
\ \
  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\ ================================================================
\ 12 string gp.name
1  string rain.flag                                                  1661
  0. sum.p.pos :=
  0. sum.p.neg :=
  0. sum.m.slo :=
real dim[ 6 ] array dev.p.pos
     dim[ 6 ] array dev.p.neg                                        1666
     dim[ 6 ] array dev.m.slo

: sta.to123
  line.# 1 +  1   \ i: # of bands, graph.#: segment
  do                                                                 1671
    sum.p.pos [ i ]  graph.#  1 - #.graph - float /  sum.p.pos [ i ] :=
    sum.p.neg [ i ]  graph.#  1 - #.graph - float /  sum.p.neg [ i ] :=
    sum.m.slo [ i ]  graph.#  1 - #.graph - float /  sum.m.slo [ i ] :=

    p.pos.2d xsect[ i , ! ] sub[ 1 , graph.#  1 - #.graph - ]        1676
      variance sqrt dev.p.pos [ i ] :=
    p.neg.2d xsect[ i , ! ] sub[ 1 , graph.#  1 - #.graph - ]
      variance sqrt dev.p.neg [ i ] :=
    m.slo.2d xsect[ i , ! ] sub[ 1 , graph.#  1 - #.graph - ]
      variance sqrt dev.m.slo [ i ] :=                               1681
  loop

  " -"    123.ary.s  ":=
  gp.name  " -%pos" "cat 123.ary.s  "[ 1 ]  ":=
  123.ary.s   123.file.name   1     1  gp.flag 1 -  3 *  + " d"       1686
              ato123.bat.new.str
  sum.p.pos
  dev.p.pos catenate 123.file.name   11    1  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.num
                                                                     1691
  gp.name  " -%neg" "cat 123.ary.s  "[ 1 ]  ":=
  123.ary.s   123.file.name   1     2  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.str
  sum.p.neg
  dev.p.neg catenate 123.file.name   11    2  gp.flag 1 -  3 *  + " d"  1696
              ato123.bat.new.num
  gp.name  " -mean slope" "cat 123.ary.s  "[ 1 ]  ":=
  123.ary.s   123.file.name   1     3  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.str
  sum.m.slo                                                          1701
  dev.m.slo catenate 123.file.name   11    3  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.num

  gp.flag 1 +  gp.flag :=
  graph.# 1 -  #.graph :=                                            1706
  10 5 fix.format
```

```
  sd
  sum.p.pos  n.type
  sum.p.neg  n.type
  sum.m.slo  n.type                                                    1711
  dev.p.pos  n.type
  dev.p.neg  n.type
  dev.m.slo  n.type
  0. sum.p.pos :=
  0. sum.p.neg :=                                                      1716
  0. sum.m.slo :=
  0. dev.p.pos :=
  0. dev.p.neg :=
  0. dev.m.slo :=
;                                                                      1721
\ ================================================================
0 non.stop.flag :=
: non.stop.op
  sc {border}
  3  2  goto.xy  ." Non-stop Operation (1:Yes, 0:No):"                 1726
                 non.stop.flag get.val non.stop.flag :=
;
\
   ------------------------------------------------------------------------

: set.eps
  1  eps.flag :=                                                       1731
  \ 0  lc.flag :=
  0  2in1.flag :=
;
: set.mon
  0  eps.flag :=                                                       1736
  1  lc.flag :=
  1  2in1.flag :=
;
\ ================================================================
\ - \ Slope of Envelope                                              1741
\ cdtNow load LMod-SF.asy \ FxW6
\ cdtNow load LMod-SB.asy \ Winds
\ cdtNow load LMod-SA.asy \ Stokes layout 1
\ cdtNow load LMod-SP.asy \ Stokes layout 2
\ ======================================== -                         1746
\ - \ Frequency and Amplitude Modulations
\ cdtNow load LMod-Mz.asy \ Test bad differentitation: LMod-F-bad-diff-
   p0m1-P1&2.asy
\ cdtNow load LMod-MA.asy \ Stokes layout 1
\ cdtNow load LMod-MP.asy \ Stokes layout 2
1 string qqq                                                           1751
: Choose.eps.mon
  " Output to Monitor (M) or EPS files (E):" s.type
  " M" get.str qqq ":=
  qqq " M" "=
  if                                                                   1756
    set.mon
  else
    set.eps
```



```
  then
;                                                                      1761
Choose.eps.mon
cdtNow load LMod-MPm.asy \ Stokes layout 2

.....................................................................................
```

```
\ ================================================================
: set.eps
  1  eps.flag :=
  \ 0  lc.flag :=
  0  2in1.flag :=
;
: set.mon
  0  eps.flag :=
  1  lc.flag :=
  1  2in1.flag :=
;
\ ================================================================
\ ================================================================
: bat.p.files
  \ ======================================== ■
  \ ---------------------------------------- ■
  " p0m1-wha.5"  do.am.fm.bat \ wave downstreqm
\   " p0m1-wha.4"  do.am.fm.bat
\   " p0m1-wha.3"  do.am.fm.bat
\   \ ---------------------------------------- ■
\   " p0m2-wha.5"  do.am.fm.bat \ wave downstreqm
\   " p0m2-wha.4"  do.am.fm.bat
\   " p0m2-wha.3"  do.am.fm.bat
\   \ ---------------------------------------- ■
\   " p0m3-wha.5"  do.am.fm.bat \ wave downstreqm
\   " p0m3-wha.4"  do.am.fm.bat
\   " p0m3-wha.3"  do.am.fm.bat
\   \ ---------------------------------------- ■
\   " p0m4-wha.5"  do.am.fm.bat \ wave downstreqm
\   " p0m4-wha.4"  do.am.fm.bat
\   " p0m4-wha.3"  do.am.fm.bat
\   \ ---------------------------------------- ■
;
\ ================================================================
: bat.a.files
  \ ======================================== ■ Depths 2, 5
  \ ---------------------------------------- ■ Wave slope
  " a0m1020.4"  do.am.fm.bat \ wave downstreqm
  " a0m2020.4"  do.am.fm.bat
  " a0m3020.4"  do.am.fm.bat
  " a0m1020.3"  do.am.fm.bat \ wave upstream
  " a0m2020.3"  do.am.fm.bat
  " a0m3020.3"  do.am.fm.bat
  \ ---------------------------------------- ■ Current
  " a0m1020.2"  do.am.fm.bat \ wave downstreqm
  " a0m2020.2"  do.am.fm.bat
  " a0m3020.2"  do.am.fm.bat
\   \ ---------------------------------------- ■ Wave slope (depth 5)
\   " a0m1050.4"  do.am.fm.bat \ wave downstreqm
\   " a0m2050.4"  do.am.fm.bat
\   " a0m3050.4"  do.am.fm.bat
\   " a0m1050.3"  do.am.fm.bat \ wave upstream
\   " a0m2050.3"  do.am.fm.bat
\   " a0m3050.3"  do.am.fm.bat
```



```
;
: bat.b.files
  \ ======================================== ■ Depths 2, 5
  \ ---------------------------------------- ■ Wind
  " b0w6020.4"  do.am.fm.bat \ wave
  " b0w5020.4"  do.am.fm.bat
  " b0w4020.4"  do.am.fm.bat
  " b0w6020.2"  do.am.fm.bat \ current
  " b0w5020.2"  do.am.fm.bat
  " b0w4020.2"  do.am.fm.bat
  \ ---------------------------------------- ■ Wind
  " b0w6050.4"  do.am.fm.bat \ wave
  " b0w5050.4"  do.am.fm.bat
  " b0w4050.4"  do.am.fm.bat
  " b0w6050.2"  do.am.fm.bat \ current
  " b0w5050.2"  do.am.fm.bat
  " b0w4050.2"  do.am.fm.bat
\   \ ======================================== ■ Rain Intensities
\   \ ---------------------------------------- ■
\   " b0w6020.4"  do.am.fm.bat \ wave
\   " b1w6020.4"  do.am.fm.bat
\   " b3w6020.4"  do.am.fm.bat
\   " b4w6020.4"  do.am.fm.bat
\   " b0w6020.2"  do.am.fm.bat \ current
\   " b1w6020.2"  do.am.fm.bat
\   " b3w6020.2"  do.am.fm.bat
\   " b4w6020.2"  do.am.fm.bat
;
: bat.f.files
  " f0w6020.2"  do.am.fm.bat
  " f0w6020.1"  do.am.fm.bat
  " f0w6030.2"  do.am.fm.bat
  " f0w6030.1"  do.am.fm.bat
  " f0w6040.2"  do.am.fm.bat
  " f0w6040.1"  do.am.fm.bat
  " f0w6050.2"  do.am.fm.bat
  " f0w6050.1"  do.am.fm.bat
  " f0w6090.2"  do.am.fm.bat
  " f0w6090.1"  do.am.fm.bat
;
\ ================================================================
\ \ ------------------------------------------------------------
\ 0 non.stop.flag :=
\ : non.stop.op
\   sc {border}
\   3  2  goto.xy  ." Non-stop Operation (1:Yes, 0:No):" non.stop.flag
   get.val non.stop.flag :=
\ ;
\ ----------------------------------------------------------------
: do.mod.bpf&hil
  25      #.wei :=
  1       m.s.freq.flag :=
  40      m.s.freq :=
  1  plot.bpf&hil  :=
  0  showflag :=
```

```
  \ ---------------------------------------- ■
  " a" pha.or.amp ":=
  " a0m1020.3"  get.s.freq.ori                111
  0       x.beg :=
  6       x.end :=
  \ ---------------------------------------- ■
  set.mod
  ato123.bat.ini.bat.all                      116
  1  graph.#  :=
\  " b0w6020.4"  loop.gen.mod
\  " a0m1020.4"  loop.gen.mod
  " a0m1020.4"  do.am.fm.bat
  ibm.graphics  \ %                           121
  def.vuport
;
\ set.eps
\ 1 lc.flag :=
\ non.stop.op                                 126
\ do.mod.bpf&hil
\ ================================================================
: do.mod
  1       m.s.freq.flag :=
  40      m.s.freq :=                         131
  0       plot.bpf&hil :=
  \ \ ---------------------------------------- ■
  \ " a"   pha.or.amp ":=
  " a0m1020.4"  get.s.freq.ori
  \ 0       x.beg :=                          136
  \ 6       x.end :=
  \ \ ---------------------------------------- ■
  set.mod
  ato123.bat.ini.bat.all
  set.lc                                      141
  \ ---------------------------------------- ■
  \ " a0m1020.3"  do.am.fm.bat
  bat.a.files
  bat.b.files
  \ ---------------------------------------- ■  146
  ibm.graphics  \ %
  def.vuport
;
: do.mod.F
  0       m.s.freq.flag :=                    151
  \ 40      m.s.freq :=
  0       plot.bpf&hil :=
  \ ---------------------------------------- ■
  \ " p"   pha.or.amp ":=
  " f0w6020.2"  get.s.freq.ori                156
  \ 0       x.beg :=
  \ 6       x.end :=
  \ ---------------------------------------- ■
  set.mod
  ato123.bat.ini.bat.all                      161
  set.lc
  \ ---------------------------------------- ■
```



```
  \ " f0w6020.2"  do.am.fm.bat
  bat.f.files
  \ ---------------------------------------- ■  166
  ibm.graphics  \ %
  def.vuport
;
\ non.stop.op
\ ================================================================  171
\ ----------------------------------------------------------------
: run.all
  non.stop.op
  \ \ ======================================== ■
  \ do.mod.bpf&hil                            176
  \ \ ======================================== ■
  " p"   pha.or.amp ":=
  0       x.beg :=
  20      x.end :=
  \ \ ---------------------------------------- ■  181
  \ do.mod
  do.mod.F
  \ \ ======================================== ■
  " a"   pha.or.amp ":=
\   0       x.beg :=                          186
\   6       x.end :=
\   \ 1 showflag :=
\   \ \ ---------------------------------------- ■
\   do.mod
  do.mod.F                                    191
\   \ \ ======================================== ■
;
\ set.eps
\ 1 lc.flag :=
\ run.all                                     196

: do.mod.now.p
  25 #.wei :=
  "null spe.hil ":=
  1       m.s.freq.flag :=                    201
  40      m.s.freq :=
  \ 0       m.s.freq.flag :=
  \ 40      m.s.freq :=
  0       plot.bpf&hil :=
  \ ======================================== ■  206
  " p"   pha.or.amp ":=
  " p0m1-wha.4"  get.s.freq.ori
  \ " f0w6020.2"  get.s.freq.ori
  \ ---------------------------------------- ■
  0.                                          211
          x.beg :=
  #.fft.pts 1 - float   m.s.freq float  /
          x.end :=
  \ 0       x.beg :=
  \ 20      x.end :=                          216
  \ ---------------------------------------- ■
  set.mod
```

```
  ato123.bat.ini.bat.all
  set.lc
  \ ---------------------------------------- ■
  bat.p.files
  \ ======================================== ■
  " a"    pha.or.amp ":=
  \ ---------------------------------------- ■
  bat.p.files
  \ ---------------------------------------- ■
  ibm.graphics  \ %
  def.vuport
;
set.eps
1 lc.flag :=
\ non.stop.op
\ \ do.mod.bpf&hil
do.mod.now.p

\ ------------------------------------------------------------------
: do.mod.now.f
  25 #.wei :=
  "null spe.hil ":=
  0       m.s.freq.flag :=
  \ 40      m.s.freq :=
  0       plot.bpf&hil :=
  \ ---------------------------------------- ■
  " p"    pha.or.amp ":=
  " f0w6020.2"  get.s.freq.ori
  0       x.beg :=
  20      x.end :=
  \ ---------------------------------------- ■
  set.mod
  ato123.bat.ini.bat.all
  set.lc
  \ ---------------------------------------- ■
  bat.f.files
  \ ---------------------------------------- ■
  ibm.graphics  \ %
  def.vuport
;
\ set.eps
\ 1 lc.flag :=
\ non.stop.op
\ do.mod.now.f
\ ------------------------------------------------------------------
\ ==================================================================
```

LMod-0.asy

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```
: LMod.asy ; \ %----- Asyst Prog -*- txt:asy -*-                                1
\ ------------------------------------------------------------------
\ Amplitude, Phase, and Frequency modulations
\ ------------------------------------------------------------------
sd
def.vuport                                                                    6
xlyl
vertical axis.fit.on
integer scalar #.WEI                    scalar bpf.flag
        scalar #.frac                   scalar plot.bpf&hil
        scalar #.frac.2                 scalar spe.bpf.flag                  11
        scalar smo.flag                 scalar pt.beg
        scalar b.p.flag                 scalar pt.beg.2
        scalar channel.#                scalar pt.end.2
        scalar hil.flag                 scalar s.freq.ori
        scalar #.neg                    scalar ord.flag                      16
        scalar #.pos                    scalar non.stop.flag

real    scalar m.s.freq                 scalar b.p.s.2
        scalar m.s.freq.flag            scalar b.p.e.2
        scalar band.stop.hil            scalar b.p.t                         21
        scalar band.start.hil           scalar x.beg
        scalar b.p.s                    scalar x.end
        scalar b.p.e                    scalar mean.slope

1       string pha.or.amp               64      string spe.hil               26
1       string wnd.str                  64      string spe.bpf
12      string pcx.1                    32      string y.label
12      string pcx.2                    \ 14      string d&t.string
12      string pcx.3                    1       string mod.flag
12      string f.name.s                 2       string wave.type.str         31
64      string spe.gen                  8       string n.str1
12      string gp.name

cdtNow load get-x-n.asy
cdtNow load to123-1.asy                                                      36

token   ori.t   exp.mem>  ori.t         token   pha.t   exp.mem>  pha.t
token   alt.t   exp.mem>  alt.t         token   fre.t   exp.mem>  fre.t
token   inp.t   exp.mem>  inp.t         token   fre2.t  exp.mem>  fre2.t
token   qua.t   exp.mem>  qua.t         token   a.t     exp.mem>  a.t        41
token   env.t   exp.mem>  env.t         token   c.t     exp.mem>  c.t
token   hit.t   exp.mem>  hit.t         token   x.t     exp.mem>  x.t
token   hif.t   exp.mem>  hif.t         token   y.t     exp.mem>  y.t
token   bpt.t   exp.mem>  bpt.t         token   z.t     exp.mem>  z.t
token   bpf.t   exp.mem>  bpf.t         token   ps.t    exp.mem>  ps.t       46
token   tmp.t   exp.mem>  tmp.t

integer scalar  iii                     scalar  #.lines
        scalar  showflag                scalar  cut.f
        scalar  #.sec                   scalar  cut.f.p                      51
        scalar  line.#                  scalar  peak.flag
        scalar  c.#.b                   scalar  f.no.c
        scalar  h.c.flag                scalar  yfix.flag
```



```
        scalar  i.p.c
                                                                             56
dp.real scalar  v.min                   dp.real scalar  x.v.min
dp.real scalar  y.v.min                 dp.real scalar  x.v.max
dp.real scalar  y.v.max

real    dim[ 6 ] array  p.pos           dim[ 6 ] array  m.slo               61
        dim[ 6 ] array  p.neg

cdtNow load eps-word.asy

real 5 ramp becomes> 123.ary.n                                               66
real 5 ramp becomes> 123.ary.n0
\ ================================================================
" bpf.pcx" pcx.1     ":=  \ Bandpass
" hil.pcx" pcx.2     ":=  \ Hilbert
" env.pcx" pcx.3     ":=  \ Envelope                                         71
" x"    wnd.str   ":=
0       plot.bpf&hil  :=
0       showflag :=
\ ---------------------------------------- ■
1       ord.flag  :=  \ \\ this is system default value                      76
\ ---------------------------------------- ■
0       m.s.freq.flag :=
\ 40      m.s.freq :=
\ ---------------------------------------- ■
1024    #.fft.pts :=    \ a0m1020.2 sub[ 130 , 512 ] --> edge effects        81
0       smo.flag :=
1       x.conv.flag :=
1       pt.beg :=
4       channel.# :=
5       peak.flag :=                                                         86
1       b.p.flag :=
\ ---------------------------------------- ■
1       hil.flag :=  \ Hilbert algorithm (Minimax or not)
25      #.wei :=
1.1     band.start.hil :=  \ Hilbert (symmetry)                              91
\ 5.5     band.start.hil :=  \ Hilbert (symmetry)
\ 3.5     band.start.hil :=  \ Hilbert (symmetry)
1       #.frac :=
\  4       #.frac.2 :=  \ not used  \ used when p.inc <> 1  --> computed
   in get.p.inc
\ \ ---------------------------------------- ■                              96
\ 0.
\         x.beg :=
\ #.fft.pts 1 - float   m.s.freq float  /
\         x.end :=
\ \ ---------------------------------------- ■                             101
\ 0       x.beg :=
\ 6       x.end :=
\ ---------------------------------------- ■
\ ================================================================
: take.part                                                                 106
\   \ ---------------------------------------- ■
\   0   x.beg :=
```

```
\   6   x.end :=
\   \ ---------------------------------------- ■
  x.beg  s.freq *  ceiling  pt.beg.2  :=                    111
  pt.beg.2  1 +             pt.beg.2  :=
  x.end  s.freq *  floor    pt.end.2  :=
  pt.end.2  1 +             pt.end.2  :=
  sub[ pt.beg.2 , pt.end.2 pt.beg.2 - ]
  swap                                                       116
  sub[ pt.beg.2 , pt.end.2 pt.beg.2 - ]
  swap
  world.coords
  horizontal
  axis.fit.off                                               121
  x.beg  x.end  world.set
;
\ ================================================================
: set.bpf.hil
  i                                                          126
  case
    1 of 45 #.wei := endof
    2 of 35 #.wei := endof
    3 of 35 #.wei := endof
    4 of 25 #.wei := endof                                   131
    5 of 25 #.wei := endof
  endcase
  wave.type.str " M1" "=
  if
    peak.flag                                                136
    case
    1 of  1.2 band.start.hil :=  endof \  1.4  1.0  1.4
    2 of  2.4 band.start.hil :=  endof \  2.8  1.8  2.8
    3 of  3.6 band.start.hil :=  endof \  4.1  3.1  4.1
    4 of  4.8 band.start.hil :=  endof \  5.4  4.4  5.4      141
    5 of  6.0 band.start.hil :=  endof \  6.8  5.8  6.8
    6 of  7.2 band.start.hil :=  endof \  8.2  7.2  8.2
    endcase
  then
  wave.type.str " M2" "=                                     146
  if
    peak.flag
    case
    1 of  1.8 band.start.hil :=  endof \  2.2  1.2  2.2
    2 of  3.6 band.start.hil :=  endof \  4.4  3.4  4.4      151
    3 of  5.5 band.start.hil :=  endof \  6.5  5.5  6.5
    4 of  7.4 band.start.hil :=  endof \  8.5  7.5  8.5
    endcase
  then
  wave.type.str " M3" "=                                     156
  if
    peak.flag
    case
    1 of  2.0 band.start.hil :=  endof \  2.8  1.8  2.8
    2 of  4.0 band.start.hil :=  endof \  4.4  2.4  4.4      161
    3 of  6.0 band.start.hil :=  endof \  5.6  4.6  5.6
    4 of  8.0 band.start.hil :=  endof \  8.5  7.5  8.5
```



```
    endcase
  then
  wave.type.str " M4" "=                                     166
  if
    peak.flag
    case
    1 of  2.0 band.start.hil :=  endof \  2.8  1.8  2.8
    2 of  4.8 band.start.hil :=  endof \  4.4  2.4  4.4      171
    3 of  7.4 band.start.hil :=  endof \  5.6  4.6  5.6
    endcase
  then
  wave.type.str " W4" "=
  if                                                         176
    peak.flag
    case
    1 of  2.6 band.start.hil :=  endof \  3.0  2.0  3.0
    2 of  4.7 band.start.hil :=  endof \  4.8  3.8  4.8
    3 of  6.8 band.start.hil :=  endof \  6.7  5.7  6.7      181
    4 of  8.5 band.start.hil :=  endof \  8.5  7.5  8.5
    endcase
  then
  wave.type.str " W5" "=
  if                                                         186
    peak.flag
    case
    1 of  2.4 band.start.hil :=  endof \  2.8  1.8  2.8
    2 of  4.5 band.start.hil :=  endof \  4.8  3.8  4.8
    3 of  6.7 band.start.hil :=  endof \  6.7  5.7  6.7      191
    4 of  8.5 band.start.hil :=  endof \  8.5  7.5  8.5
    endcase
  then
  wave.type.str " W6" "=
  if                                                         196
    peak.flag
    case
    1 of  2.0 band.start.hil :=  endof \  2.4  1.4  2.4
    2 of  4.0 band.start.hil :=  endof \  4.5  3.5  4.5
    3 of  6.0 band.start.hil :=  endof \  6.7  5.7  6.7      201
    4 of  8.0 band.start.hil :=  endof \  8.5  7.5  8.5
    endcase
  then
  \ ===================================== ■ Redefine band.stop.hil
  s.freq  2. /   band.start.hil -   band.stop.hil :=         206
\   \ ---------------------------------------- ■
\   \ Single Hilbert window
\   1.0 band.start.hil :=
\   s.freq  2. /   band.start.hil -   band.stop.hil :=
;                                                            211
: set.bpf
  n.str1 "upper n.str1 ":=
  n.str1 4 "left 2 "right wave.type.str ":=

  set.bpf.hil                                                216
  wave.type.str " M1" "=
  if
```

```
    peak.flag
    case
    1 of   1.4 b.p.s :=      1.4 b.p.e :=      1.0 b.p.t :=   endof
    2 of   2.8 b.p.s :=      2.8 b.p.e :=      1.0 b.p.t :=   endof
    3 of   4.1 b.p.s :=      4.1 b.p.e :=      1.0 b.p.t :=   endof
    4 of   5.4 b.p.s :=      5.4 b.p.e :=      1.0 b.p.t :=   endof
    5 of   6.8 b.p.s :=      6.8 b.p.e :=      1.0 b.p.t :=   endof
    6 of   8.2 b.p.s :=      8.2 b.p.e :=      1.0 b.p.t :=   endof
    endcase
  then
  wave.type.str " M2" "=
  if
    peak.flag
    case
    1 of   2.2 b.p.s :=      2.2 b.p.e :=      1.0 b.p.t :=   endof
    2 of   4.4 b.p.s :=      4.4 b.p.e :=      1.0 b.p.t :=   endof
    3 of   6.5 b.p.s :=      6.5 b.p.e :=      1.0 b.p.t :=   endof
    4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
    endcase
  then
  wave.type.str " M3" "=
  if
    peak.flag
    case
    1 of   2.6 b.p.s :=      2.6 b.p.e :=      1.0 b.p.t :=   endof \ 2.8
    2 of   4.5 b.p.s :=      4.5 b.p.e :=      1.0 b.p.t :=   endof \ 4.4
    3 of   6.5 b.p.s :=      6.5 b.p.e :=      1.0 b.p.t :=   endof \ 5.6
    4 of   8.6 b.p.s :=      8.6 b.p.e :=      1.0 b.p.t :=   endof \ 8.5
    endcase
  then
  wave.type.str " M4" "=
  if
    peak.flag
    case
    1 of   2.8 b.p.s :=      2.8 b.p.e :=      1.5 b.p.t :=   endof \ 2.8
    2 of   5.6 b.p.s :=      5.6 b.p.e :=      1.5 b.p.t :=   endof \ 4.4
    3 of   8.4 b.p.s :=      8.4 b.p.e :=      1.5 b.p.t :=   endof \ 5.6
    endcase
  then
  wave.type.str " W4" "=
  if
    peak.flag
    case
    1 of   3.0 b.p.s :=      3.1 b.p.e :=      1.0 b.p.t :=   endof
    2 of   4.8 b.p.s :=      4.8 b.p.e :=      1.0 b.p.t :=   endof
    3 of   6.7 b.p.s :=      6.7 b.p.e :=      1.0 b.p.t :=   endof
    4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
    endcase
  then
  wave.type.str " W5" "=
  if
    peak.flag
    case
    1 of   2.8 b.p.s :=      2.8 b.p.e :=      1.0 b.p.t :=   endof
    2 of   4.8 b.p.s :=      4.8 b.p.e :=      1.0 b.p.t :=   endof
```



```
    3 of   6.7 b.p.s :=      6.7 b.p.e :=      1.0 b.p.t :=   endof
    4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
    endcase
  then
  wave.type.str " W6" "=
  if
    peak.flag
    case
    1 of   2.4 b.p.s :=      2.4 b.p.e :=      1.0 b.p.t :=   endof
    2 of   4.5 b.p.s :=      4.5 b.p.e :=      1.0 b.p.t :=   endof
    3 of   6.7 b.p.s :=      6.7 b.p.e :=      1.0 b.p.t :=   endof
    4 of   8.5 b.p.s :=      8.5 b.p.e :=      1.0 b.p.t :=   endof
    endcase
  then

  bpf.flag 2 =
  if
     b.p.s.2  b.p.s :=
     b.p.e.2  b.p.e :=
     b.p.t    b.p.t :=
  else
  then
;
\ ============================================================

"date   " -"  "cat   "time  "cat   d&t.string  ":=
: put.d&t
  normal.coords
  0.80  0.97 position  d&t.string  label
  world.coords
;

: put.spe
  normal.coords
  2.wnd.flag  1 =
  if
    0.17  0.97 position   spe.gen                                label
    \     0.17  0.91 position   spe.hil   spe.bpf   "cat      label
\    0.17  0.91 position   spe.hil                                 label
    0.17
    eps.flag 1 =
    if     0.88
    else   0.91
    then         position   spe.hil                               label
  else
    0.17  0.97 position   spe.gen                                label
    0.17  eps.flag 1 = if 0.93 else 0.93 then position   spe.hil
    spe.bpf.flag  1 =
    if
      spe.bpf  "cat
    then
    label
  then
  world.coords
```

```
  int.flag  1 =
  if
      normal.coords                                                    331
      0.60  0.92   key.orig
      line.#   dup
      \      "spe.str "[ 1 ] "upper " XY"  =
      "spe.str "[ 1 ] "upper "null "=
      if                                                               336
        f.name.s
      else
        "spe.str "[ line.# ]
      then
      mkl.bat                                                          341
      key.done
      world.coords
  then
;                                                                      346
: get.spe
  \ !-------------------------
  \  #.wei;band.start.hil,band.stop.hil
  \  "  [25w;2.5,17.5]"
\ \ fixed #.wei                                                        351
\  pha.or.amp  "upper " A" "=
\   pha.or.amp " a" "=
\   if
\     i 1 =
\     if                                                               356
\       " {HI<="
\       #.wei         0    n>s    "cat  " W}"  "cat
\       band.start.hil  -2    n>s    "cat  " ,"   "cat
\       band.stop.hil   -2    n>s    "cat  " |"   "cat
\     else                                                             361
\         spe.hil
\         band.start.hil  -2    n>s    "cat  " ,"   "cat
\         band.stop.hil   -2    n>s    "cat  " |"   "cat
\     then
\   else                                                             366
\     i 1 =
\     if
\       " {HI<="
\       #.wei         0    n>s    "cat  " W}"  "cat
\       band.start.hil  -2    n>s    "cat  " ,"   "cat              371
\       band.stop.hil   -2    n>s    "cat  " |"   "cat
\     else
\         spe.hil
\         band.start.hil  -2    n>s    "cat  " ,"   "cat
\         band.stop.hil   -2    n>s    "cat  " |"   "cat              376
\     then
  pha.or.amp  " a" "=
  if
    i 1 =
    if                                                                 381
      " {HI|W-S,E}"
      #.wei             0    n>s    "cat  " -"  "cat
```



```
      band.start.hil  -2    n>s    "cat  " ,"   "cat
      band.stop.hil   -2    n>s    "cat  " |"   "cat
    else                                                               386
        spe.hil
        #.wei             0    n>s    "cat  " -"  "cat
        band.start.hil  -2    n>s    "cat  " ,"   "cat
        band.stop.hil   -2    n>s    "cat  " |"   "cat
    then                                                               391
  else
    i 1 =
    if
      " {HI|W-S,E}"
      #.wei             0    n>s    "cat  " -"  "cat                  396
      band.start.hil  -2    n>s    "cat  " ,"   "cat
      band.stop.hil   -2    n>s    "cat  " |"   "cat
    else
        spe.hil
        #.wei             0    n>s    "cat  " -"  "cat                401
        band.start.hil  -2    n>s    "cat  " ,"   "cat
        band.stop.hil   -2    n>s    "cat  " |"   "cat
    then
  \ ---------------------------------------- -
  \  #.wei         0    n>s    "cat  " W}"  "cat                       406
  then
  spe.hil  ":=
     int.flag  1 =
     if
       "null                                                           411
     else
     " CASE:"      f.name.s                  "cat    "  "  "cat
     then
     " ["                                   "cat
     pt.beg        0    n>s    "cat  " ,"    "cat                     416
     #.fft.pts     0    n>s    "cat  " ]"    "cat
     "  <S:"                                "cat
     smo.flag      0    n>s    "cat  " ,"    "cat
     " wnd:"                                "cat
     wnd.str   "upper          "cat  " ,"    "cat                     421
     " F:"                                  "cat
     m.s.freq      0    n>s    "cat  " >"    "cat
  spe.gen  ":=
     \  bandpass[ 2.5 , 3.5 , 1.2 ]        filter
     " {BP:"                                                           426
     b.p.s        -2    n>s    "cat  " ,"    "cat
     b.p.e        -2    n>s    "cat  " ,"    "cat
     b.p.t        -1    n>s    "cat  " }"    "cat
  spe.bpf ":=
;                                                                      431
: call.hil.out
             eps.flag 1 =
             if
               end.gr.out
             else                                                      436
               hp.new  cdf.now.str   pcx.2 "cat  defer> vup>pcx
             then
```

```
;
: call.bpf.out
              eps.flag 1 =                                                  441
              if
                end.gr.out
              else
                hp.new  cdf.now.str   pcx.1 "cat  defer> vup>pcx
              then                                                          446
;
: call.lab.amp
  \  x.label    "  --- Amplitude Modulation"     "cat
  x.label  \  "  --- Amplitude Modulation"     "cat
  x.label  ":=                                                              451
  plot.bpf&hil  1 <>
  if
    " Amplitude (cm)"
    y.label  ":=
    label.xy                                                                456
  else
    " Displacement and Amplitude (cm)"
    y.label  ":=
    label.xy
    eps.flag 1 =  not                                                       461
    if
      hp.new cdf.now.str    pcx.3  "cat  defer> vup>pcx
    then
  then
;                                                                           466
: call.lab.pha
  \  x.label    "  --- Phase Modulation"     "cat
  x.label  \  "  --- Phase Modulation"     "cat
  x.label  ":=
  " Phase (Radian)"                                                         471
  y.label  ":=
  label.xy
  eps.flag 1 =  not
  if
  hp.new  cdf.now.str      pcx.3  "cat  defer> vup>pcx                      476
  then
;
: call.lab.fre
\  x.label    "  --- Frequency Modulation for Individual Band"     "cat
  x.label \    "  --- Frequency Modulation for Individual Band"     "cat    481
  x.label  ":=
  " Frequency (Hz)"
  y.label  ":=
  label.xy
  eps.flag 1 =  not                                                         486
  if
    hp.new cdf.now.str      pcx.3  "cat  defer> vup>pcx
  then
;
\ ------------------------------------------------------------------        491
: get.log.min
  dup  0.  >
```



```
  if
  11.  v.min :=
  begin                                                                     496
  dup
  v.min   1 -  v.min  :=
  10.  v.min  **    swap /     1.    <
  until
  10. v.min  **    v.min    :=                                              501
  drop
  else
     v.min :=
  then
;                                                                           506

: get.x.v.res
  swap
       dup  []min/max   x.v.max   :=   get.log.min  v.min  x.v.min  :=
  swap                                                                      511
       dup  []min/max   y.v.max   :=   get.log.min  v.min  y.v.min  :=
;
: get.x.v
  swap
       dup  []min/max   x.v.max   :=                                        516
       x.axis.flag  " o"  "=
       if   get.log.min  v.min
       then
       x.v.min  :=
  swap                                                                      521
       dup  []min/max   y.v.max   :=
       y.axis.flag  " o"  "=
       if   get.log.min  v.min
       then
       y.v.min  :=                                                          526
;
: change.w.s.bpf.t
    \ get.x.v
    horizontal
       x.v.min    x.v.max     world.set                                     531
    vertical
       axis.fit.off
       -1.2       0       5   label.format
       -0.125     0.125       world.set
;                                                                           536
: change.w.s.bpf.f
    horizontal
       \ x.v.min    x.v.max     world.set
       0.            10.     world.set
    vertical                                                                541
       axis.fit.off
       -1.2       0       5   label.format
    \  y.v.min    y.v.max     world.set
       0.00       1.25        world.set
;                                                                           546
: change.w.s.hil.t
    horizontal
```

```
      x.v.min     x.v.max      world.set
   vertical
      axis.fit.off                                                    551
      -1.2        0        5   label.format
      -1.00       1.00         world.set
;
: change.w.s.hil.f
   horizontal                                                         556
       \ x.v.min     x.v.max      world.set
       0.00         x.v.max      world.set
   vertical
      axis.fit.off
      -1.2        0        5   label.format                          561
   \  y.v.min     y.v.max      world.set
      0.00        1.25         world.set
;
: set.w.s.x
   horizontal                                                         566
       axis.fit.off
       x.axis.flag   " o"  "=
       if
         x.v.min     x.v.max      world.set
       else                                                          571
         x.beg       x.end        world.set
       then
;
: change.w.s.amp
  set.w.s.x                                                          576
;
: change.w.s.amp.y
   vertical
    channel.#     2  <=
    if                                                               581
      -1.2        0        5   label.format
      b.p.flag  0  =
      if
         -2.0        2.0          world.set
      else                                                          586
         -10.        10.          world.set
      then
   else
      -1.2        0        5   label.format
      b.p.flag  0  =                                                 591
      if
         -2.0        2.0          world.set
      else
         -1.0        1.0          world.set
      then                                                          596
   then
   \  0.00        1.25         world.set
;
: change.w.s.fre   \ for frequency modulation
  set.w.s.x                                                          601
   vertical
\     axis.fit.off
```



```
      -1.2        0        5   label.format
      0.0         10.          world.set
;                                                                    606
: change.world.set.ps
  channel.#     2  <=
  if
    horizontal
      x.v.min     x.v.max      world.set                           611
\     0.2         x.v.max      world.set
   vertical
     -1.2         0        7   label.format
\     y.v.min     y.v.max      world.set
      yfix.flag 1 =                                                616
      if
        y.axis.flag   " o"  "=
        if
          10. -4. ** 10. 2. **    world.set
        else                                                        621
        \  0           15.          world.set
          0           10.          world.set
        then
      else
         y.v.min     y.v.max      world.set                       626
      then
  else      \ ch.3 4 5
    horizontal
      x.v.min     x.v.max      world.set
\     0.2         x.v.max      world.set                           631
   vertical
     -1.2         0        7   label.format
      yfix.flag 1 =
      if
        y.axis.flag  " o"  "=                                       636
        if
          10. -5. ** 10.  1. **  world.set
        else
          axis.fit.off
         -1.2         0        4   label.format                    641
          0.          0.25         world.set
        then
      else
         y.v.min     y.v.max      world.set
      then                                                          646
  then
;
\ ------------------------------------------------------------------

: get.p.inc   \ reset s.freq                                        651
  b.p.flag  1 <>
  if    0  b.p.s :=    0  b.p.e :=   0  b.p.t :=  then
  m.s.freq.flag  1 =
  if
    s.freq.ori   m.s.freq  /  p.inc :=                              656
    s.freq.ori   p.inc  float /
    s.freq :=
```

```
  else
    1 p.inc :=
  then                                                              661
;
: get.smo
  smo.flag 1 =
  if  smooth  then
;                                                                   666
: plot.hil.Re&Im
  hit.t  fft
  SUB[ 1 , #.FFT.PTS  #.frac / ]
  dup
\ %%  zreal up                                                      671
  zreal up.new
  1 yap
\ %%  zimag dp
  zimag dp.new
  2 ydp  my.pause                                                   676
;

\ ================================================================
\ There are very strange behavior of x.label here.
\ x.label behaviors differently when get.x.time and get.x.freq are not   681
   placed
\ in this file (i.e., placed in Get-X-N.asy)
\ ----------------------------------------------------------------
: get.x.time
  []size  ramp
  x.axis.flag  " l"  "=                                             686
  if
    1.  -
  then
  x.conv.flag  1  =
  \  " Point"  x.label  ":=                                        691
  if
    " Time (sec)"  x.label  ":=
    float      s.freq  /  becomes> x.time
    x.time
  else                                                              696
    " Point"  x.label  ":=
  then
  \ x.label s.type
  \ x.label " <---GotT--- " "cat get.str "drop
  swap                                                              701
  \ ---------------------------------------- -
  atoa.flag  1  =
  if
  2  pick      2  pick
  #.xy  1 +  #.xy  :=                                               706
  then
;
: get.x.freq     \ chech get-x-n ? (08-01-97)
  []size  ramp   \ 1.  -
  \  " Point"  x.label  ":=                                        711
  x.conv.flag  1  =
```



```
  if
    " Frequency (Hz)"  x.label  ":=
    float    s.freq  float  *  #.fft.pts  float  /  becomes> x.freq
    x.freq                                                          716
    \ " Frequency (Hz)"  x.label  ":=
  else
    " Point"  x.label  ":=
  then
  \ x.label s.type                                                  721
  \ x.label " <---GotF--- " "cat get.str "drop
  swap
  atoa.flag  1  =
  if
  2  pick      2  pick                                              726
  #.xy  1 +  #.xy  :=
  then
;
\ ----------------------------------------------------------------
: plot.bpf  \ [ array - ]                                           731
  plot.bpf&hil  1 <>
  if
    drop  exit
  then
            eps.flag 1 =                                            736
            if
              cdf.now.str " BPF-FIR.eps"  "cat "dup  ps.file.name ":=
              defer> ps.file
              ini.gr.out
              ps.hp ps.up  ps.dp                                    741
            else  gd  hp
            then
  \ %% gd hp
  \ %% up
  hp.new                                                            746
  up.new
    0  x.conv.flag :=
    1  x.conv.flag :=
    \ cr x.label s.type.2 \ strange behavior of x.label here
    get.x.time                                                      751
    \ x.label s.type.2
    \ x.label get.str "drop
    get.x.v
    xy.data.fit
    change.w.s.bpf.t                                                756
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    2  xydp
    put.spe                                                         761
    put.d&t
    x.label "  --- Bandpass Filter in Time Domain" "cat
    \      " Point --- Bandpass Filter in Time Domain"
     " Response"  0.02 labxy.stack
  \ %%  dp                                                          766
  dp.new
```

```
    #.fft.pts  #.wei -  real  ramp  becomes>  tmp.t
    0.  tmp.t  :=
    tmp.t  filter.fir  catenate
    #.fft.pts  #.wei -  2 / rotate                                    771
    becomes> tmp.t      \ zero padded filter response

    tmp.t fft zmag      \ FIR in Frequency domain
    becomes> bpf.t
    bpf.t   SUB[ 1 , #.FFT.PTS  #.frac /  5 / ]                       776
    1  x.conv.flag :=
    get.x.freq
    get.x.v
    xy.data.fit
    change.w.s.bpf.f                                                  781
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    4  xydp
    x.label "  --- Bandpass Filter in Frequency Domain" "cat          786
    \      " Point --- Bandpass Filter in Frequency Domain"
    " Window"  0.02 labxy.stack
    call.bpf.out
    \ solid outline     \ %% strange behavior (may be due to abnormal
       stop?)
  eps.flag 1 = if  else my.pause then                                 791
;
\ ------------------------------------------------------------------
: plot.hil.FIR   \ [ array - ]
  plot.bpf&hil  1 <>
  if                                                                  796
    drop  exit
  then
            eps.flag 1 =
            if
              cdf.now.str " Hil-FIR.eps"  "cat  "dup  ps.file.name ":=  801
              defer> ps.file
              ini.gr.out
              ps.hp ps.up  ps.dp
            else  gd  hp
            then                                                      806
  hp.new
  up.new
    0  x.conv.flag :=
    1  x.conv.flag :=
    \ cr  x.label s.type.2 \ strange behavior of x.label here         811
    get.x.time
    \ x.label s.type.2
    \ x.label get.str "drop \ for test
    get.x.v
    xy.data.fit                                                       816
    change.w.s.hil.t
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    2  xydp                                                           821
```



```
    put.spe
    put.d&t
    x.label "  --- Hilbert FIR in Time Domain" "cat
    \      " Point --- Hilbert FIR in Time Domain"
    " Response"  0.02 labxy.stack                                     826
    \ solid outline
  dp.new
    #.fft.pts  #.wei -  real  ramp  becomes>  tmp.t
    0.  tmp.t  :=
    tmp.t  filter.fir  catenate                                       831
    #.fft.pts  #.wei -  2 / rotate
    becomes> tmp.t      \ zero padded filter response
    tmp.t fft zmag      \ FIR in Frequency domain
    #.fft.pts 2 / rotate
    \ #.fft.pts 4 /  neg rotate                                       836
    SUB[ 1 , #.FFT.PTS  #.frac /  2 / ]
    1  x.conv.flag :=
    get.x.freq
    get.x.v
    xy.data.fit                                                       841
    change.w.s.hil.f
    \ get.fit.axis
    xy.axis.plot
    put.grid.lines
    4  xydp                                                           846
    x.label "  --- Hilbert FIR in Frequency Domain" "cat
    \ " Point --- Hilbert FIR in Frequency Domain"
    " Window"  0.02 labxy.stack
    call.hil.out
  eps.flag 1 = if  else my.pause then                                 851
;
\ ==================================================================
: make.wks.1   \ for col.beg=0, [ x, y, " 123.f.n" - x, y ]
               \ for col.beg>0, [    y, " 123.f.n" - y ]
  cr                                                                  856
          col.beg  0  =  \ x axis
          if
            col.beg  1 +  col.beg :=
            x.label             " $" "cat  123.ary.s0 "[ 1 ]  ":=
            y.label             " $" "cat  123.ary.s0 "[ 2 ]  ":=     861
            f.name.s            " $" "cat  123.ary.s0 "[ 3 ]  ":=
            spe.gen             " $" "cat  123.ary.s0 "[ 4 ]  ":=
            mod.flag " p" "= if  " Fre-M" then
            mod.flag " a" "= if  " Amp-M" then
            " !" "cat                                                 866
            d&t.string  "cat    " $" "cat  123.ary.s0 "[ 5 ]  ":=

            2  pick
              123.file.name.1   row.beg  col.beg      " d"
                 ato123.bat.new
          then                                                        871

          col.beg  1 +  col.beg :=
          f.name.s          " -B"  "cat  peak.flag  0 n>s  "cat
                          " $" "cat  123.ary.s "[ 1 ]  ":=
```

```
            spe.bpf              " $" "cat  123.ary.s "[ 2 ]  ":=
            spe.hil              " $" "cat  123.ary.s "[ 3 ]  ":=
            spe.gen              " $" "cat  123.ary.s "[ 4 ]  ":=
            " ---"               " $" "cat  123.ary.s "[ 5 ]  ":=
            dup
                123.file.name.1   row.beg  col.beg       " d"
                   ato123.bat.new
;
: make.wks.2   \ for col.beg=0, [ x, y, " 123.f.n" - x, y ]
               \ for col.beg>0, [    y, " 123.f.n" - y ]
  cr
            col.beg.2  0  =  \ x axis
            if
              col.beg.2  1 +  col.beg.2 :=
              x.label             " $" "cat  123.ary.s0 "[ 1 ]  ":=
              y.label             " $" "cat  123.ary.s0 "[ 2 ]  ":=
              f.name.s            " $" "cat  123.ary.s0 "[ 3 ]  ":=
              spe.gen             " $" "cat  123.ary.s0 "[ 4 ]  ":=
              mod.flag " p" "= if  " Fre-M" then
              mod.flag " a" "= if  " Env-M" then
              " !" "cat
              d&t.string  "cat    " $" "cat  123.ary.s0 "[ 5 ]  ":=
              0.  123.ary.n0  :=

              2  pick
                123.file.name.2   row.beg.2  col.beg.2   " d"
                   ato123.bat.new
            then

            col.beg.2  1 +  col.beg.2 :=
            f.name.s          " -B" "cat  peak.flag  0 n>s  "cat
                               " $" "cat  123.ary.s "[ 1 ]  ":=
            spe.bpf            " $" "cat  123.ary.s "[ 2 ]  ":=
            spe.hil            " $" "cat  123.ary.s "[ 3 ]  ":=
            spe.gen            " $" "cat  123.ary.s "[ 4 ]  ":=
            " ---"             " $" "cat  123.ary.s "[ 5 ]  ":=
            dup
                123.file.name.2   row.beg.2  col.beg.2   " d"
                   ato123.bat.new
;

: pha&fre.mod
  rad
  1  set.order
  2  set.degree

  ori.t                    becomes> x.t
  hil.flag  0  =
  if
    x.t    hilbert  neg    \  Edge effects
  else
    qua.t           neg    \  Sinuzoidal effects (Use Minimax)
  then
                           becomes> y.t
  x.t  y.t  z=x+iy         becomes> z.t
```



```
  \ ----- Plot ori & qua & envelope
  \  gd hp   x.t       sub[ 1 , #.fft.pts  #.frac / #.frac.2 /  ]  1 yap
  \          y.t       sub[ 1 , #.fft.pts  #.frac / #.frac.2 /  ]  2 ydp
  \          z.t zmag  sub[ 1 , #.fft.pts  #.frac / #.frac.2 /  ]  3 ydp
  \  my.pause

  \ ----- Carrier
  real  #.fft.pts  ramp                  \ total points
  b.p.s  b.p.e +   2. /  s.freq  /       \ cycle per point
  2.    pi *                             \ radian per point
  *     *                                \ phase of each point
  dup   cos    swap
        sin
  z=x+iy            becomes> c.t         \ carrier

\   \ ---------------------------------------- -
\   \ Without carrier
\   1 0
\   z=x+iy            becomes> c.t         \ carrier
\   \ ---------------------------------------- -

\   c.t   z.t [ 1 ] *    z.t [ 1 ] zmag /         \ commented 042097
\                  becomes> c.t          \ set initial phase to equal
\ commented 042097

  z.t  c.t  /  becomes> z.t  \ added 042097

  \ z.t  c.t *        becomes> a.t
  \ ----- Phase difference
  \ z.t   zarg  c.t  zarg  -   becomes> pha.t          \ bad method
  \ z.t        c.t        /    zarg   becomes> pha.t    \ good
  \ Wrong method
  z.t                        zarg   becomes> pha.t    \ good
  pha.t                      differentiate.data
  2. pi  *  /
  s.freq *
  becomes> fre2.t  \ this yields bad results due to direct numerical
     differentiation
\ z.t                        differentiate.data    zarg
\ z.t         c.t        /   differentiate.data    zarg
  \ Calcute dp/dt  --- use polar z=r*exp(i p)
  z.t  differentiate.data                          \ dz
  z.t  zmag   differentiate.data                   \ dr
  z.t  zarg   dup   cos   swap   sin  z=x+iy  *    \ exp(i p) * dr
  -                                                \ --> numerator
  z.t    0 1 z=x+iy  *                             \ i * z -->
     denomenator
  /

  2. pi *   /      s.freq *        \ change unit from radian to
     frequency
  \ zmag                                           \ Wrong
  zreal                                            \ Yes
  \ ---------------------------------------- -
```

```
\ Without carrier
\ 0                        +
\ ---------------------------------------- -
\ With carrier
  b.p.s  b.p.e +   2. /  +   \ added 042097
\ ---------------------------------------- -
becomes> fre.t

\ 0  1  =  \  = -> Show ; <> -> no show
\ 1  1  =  \  = -> Show ; <> -> no show
1  showflag =
if
  eps.flag 1 =  not
  if gd
  then
  hp.new
  z.t   zarg
         sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
         1 yap
  c.t   zarg
         sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
         2 ydp
  rad
  my.pause
  eps.flag 1 =  not
  if gd
  then
  up.new
  pha.t
         sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
         1  x.conv.flag :=
         get.x.Time
         take.part
         get.x.v
 \ cr  ." 0---"  x.v.min .  x.v.max
 \ " TEST" get.str "drop
         xy.data.fit
         \          change.w.s.amp
         xy.axis.plot
         put.grid.lines
         line.#      xydp
         put.d&t     put.spe
         call.lab.pha
  dp.new
  fre2.t
         sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
         get.x.Time
         take.part
         get.x.v
         xy.data.fit
         \          change.w.s.amp
         xy.axis.plot
         put.grid.lines
         line.#      xydp
         put.d&t     put.spe
```



```
         call.lab.fre
  then
  \ ------------------------------------------------------------------
  \ gd    \ to allow overlap
  eps.flag 1 = not
  line.#   1 =       and
  if
    gd hp
  then
  hp.new
  fre.t
         sub[ 1 , #.fft.pts  #.frac / #.frac.2 / ]
         get.x.Time
         take.part
         get.x.v
         x.v.min  n.type  x.v.max .
         \ cr  ." 2---"  x.v.min .  x.v.max  .    ."  2"  2  get.val
             drop

         " Frequency (Hz)"  y.label ":=
         0.  123.ary.n  :=
         make.wks.1

         xy.data.fit

         change.w.s.fre
         xy.axis.plot
         put.grid.lines

         line.#      xydp                    \ added 04-11-97
   \     2  *drop                            \ ----   when out of
      vuport
         put.d&t     put.spe
         call.lab.fre
         \           2 xydp

;

: find.neg.pos
  env.t  \ smooth
  differentiate.data
  ord.flag  2 =
  if
    differentiate.data
  then
  sort
  becomes> t1
  0 tmp.v.i  :=
  begin
    tmp.v.i  1 +  tmp.v.i  :=
    t1 [ tmp.v.i ]  0  >=
  until
  tmp.v.i  #.neg  :=
\  begin
\    tmp.v.i  1 +  tmp.v.i  :=
```

```
\    t1 [ tmp.v.i ]  0  >
\  until
\  tmp.v.i  #.pos  :=
\  env.t  []size swap drop   #.pos  -   1 +  #.pos   :=                1091
\  t1  mean
  t1  []size swap drop  tmp.v.i.2  :=
  tmp.v.i.2   #.neg -   #.pos   :=
  t1  mean
  ord.flag 2 =                                                        1096
  if
    s.freq float 2 **  *
  else
    s.freq float *
  then                                                                1101
    mean.slope  :=
;
: gen.h.t   \
  cr ." [1:Color, 2:file, 3:chan, 4:fft.pts, 5:m.s.r, 6:#.FIR 7:start
     -- ]"
  band.start.hil :=                                                   1106
  #.wei      :=
  m.s.freq   :=
  #.fft.pts  :=
  channel.#  :=
  line.#     :=                                                       1111
  "dup
  " ."  "cat
  channel.#          \  96
\  48  +  ascii"   "cat
  cr  b.p.s . b.p.e  n.type                                           1116

  0 n>s  "cat
  "dup  f.name.s  ":=
  cda.str  "swap  "cat  cr  "dup  s.type
  defer>  file.open                                                   1121
  2 subfile  file>unnamed.array  file.close
  dir.lee.dat  "swap  "cat   " .dat"  "cat  cr  "dup  s.type
  defer>  file.open
  1 subfile  file>unnamed.array   [ 3 ] s.freq :=  file.close
  \ parameter.1  parameter.2                                          1126

  get.p.inc  \ reset s.freq = m.s.freq
  \ ---------------------------------------- -
  \ \ s.freq  2. /   band.start.hil -   band.stop.hil :=
  \ ---------------------------------------- -                       1131
  \ set.bpf.hil
  \ ---------------------------------------- -
  get.spe
  get.smo
  \  sub[ 1 , #.fft.pts , p.inc ]                                    1136
  sub[ pt.beg , #.fft.pts , p.inc ]

  wnd.str   "upper " X"  "=   if                          then
  wnd.str   "upper " K"  "=   if   blackman.window.apply  then
  wnd.str   "upper " B"  "=   if   bartlett.window.apply  then        1141
```



```
  wnd.str   "upper " N"  "=   if   hanning.window.apply   then
  wnd.str   "upper " M"  "=   if   hamming.window.apply   then
  \ blackman.window.apply  \ added fot test
  \  \  ." >>>"  my.pause
                                                                      1146
\ ------------------------------------
   s.freq   filter.sample.rate
   b.p.flag  1 =
   if
     \  sd                                                            1151
     \  bandpass[ 2.5 , 3.5 , 1.2 ]
     bandpass[ b.p.s , b.p.e , b.p.t ]  filter
     filter.fir   becomes>  bpt.t
     bpt.t  plot.bpf
   then                                                               1156
  \ ------------------------------------
  1 *    \ Very important to prevent numerical underflow
  becomes> ori.t
  hilbert[ #.wei ; band.start.hil , band.stop.hil ]
  \  sd                                                              1161
  cr  #.wei .    10  4  fix.format
  plot.bpf&hil  1 =
  if
    cr band.start.hil . cr band.stop.hil .  cr  n.type  \  MY.PAUSE
  then                                                               1166

  filter.fir    becomes> hit.t   \ FIR in Time domain

  \ plot.hil.Re&Im
  hit.t  plot.Hil.FIR                                                1171

  plot.bpf&hil  1 =
  if
\             eps.flag 1 =
\             if                                                    1176
\               cdf.now.str " 03.eps"  "cat "dup  ps.file.name ":=
\               defer> ps.file
\               ini.gr.out
\               ps.hp ps.up  ps.dp
\             else  gd  hp                                          1181
\             then
    exit
  then

  hil.flag 1 =                                                       1186
  if
    ori.t  filter     becomes> qua.t   \ use minimax Filter mentod
  else
    ori.t  hilbert    becomes> qua.t
  then                                                               1191
  \ ----- Amplitude modulation
  qua.t  2. **  ori.t 2. **  +  SQRT

\  0.2 set.cutoff.freq
\  smooth                                                          1196
```

```
  BECOMES> env.t

  plot.bpf&hil  1  =
  if                                                                    1201
    eps.flag 1 =  not
    if gd
    then
\ %%    gd
\ %%    hp                                                            1206
    hp.new
  then
  mod.flag  " a"   "=
  if
\ %%    ini.gr.out                                                    1211
    \ ori.t  SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
    ori.t  SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
           1  x.conv.flag :=
           get.x.Time
           take.part                                                    1216
           get.x.v
           " Amplitude (cm)"  y.label  ":=
    2in1.flag 1 =
    if
           line.#  1 =                                                  1221
           if
             eps.flag 1 =
             if
               ini.gr.out
               ps.hp ps.up  ps.dp                                       1226
             else  gd  hp
             then
             up.new
             xy.data.fit
                                                                        1231
             xy.axis.plot
             put.grid.lines
           then
           line.#  3 =
           if                                                           1236
             dp.new
             xy.data.fit
             change.w.s.amp
             xy.axis.plot
             put.grid.lines                                             1241
           then
           0.  123.ary.n  :=
           make.wks.1
           \ get.fit.axis
                                                                        1246
           line.#
           case
             2   of  up.new  endof
             4   of  dp.new  endof
             5   of  dp.new  endof                                      1251
```



```
           endcase
    else
       ini.gr.out
             eps.flag 1 = not
             if  gd  hp                                                 1256
             else  ps.hp ps.up  ps.dp
             then
             hp.new
             xy.data.fit
             change.w.s.amp                                             1261
             xy.axis.plot
             put.grid.lines
           0.  123.ary.n  :=
           make.wks.1
    then                                                                1266
           2in1.flag  1 =
           \ eps.flag 1 =
           if
             line.#
           else                                                         1271
             1
           then
           xydp
           put.d&t    put.spe
                                                                        1276
  \ ------------------------------------- -
  \ The following two "xydp" both plot the envelope curves.
  \ env.t is based on hil.flag (minimax or not).
    env.t  SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
           get.x.Time                                                   1281
           take.part
           " Amplitude (cm)"  y.label  ":=
           find.neg.pos
           0.      123.ary.n :=
           #.pos float #.fft.pts float /                                1286
                 dup p.pos [ line.# ] :=  123.ary.n [ 1 ] :=
           #.neg float #.fft.pts float /
                 dup p.neg [ line.# ] :=  123.ary.n [ 2 ] :=
           mean.slope
                 dup m.slo [ line.# ] :=  123.ary.n [ 3 ] :=            1291
           make.wks.2
           2 xYDP
  \ ------------------------------------- -
    ori.t  hilbert
    2. **  ori.t 2. **  +  SQRT                                         1296
           get.x.Time
           take.part
    1 xydp
  \ ------------------------------------- -
                                                                        1301
      normal.coords
\      line.#  2 <=
\      if
         0.60  0.90   key.orig
\          0.60  0.92   key.orig                                       1306
```

```
\       else
\          0.65  1.10   key.orig
\       then
       line.#   dup
       line.#  2 <=                                                    1311
       if
         2in1.flag 1 =
         if
         else
            line.# 1 -  -                                              1316
         then
       else
         2in1.flag 1 =
         if
            2 -  \ raise 2 lines                                       1321
         else
            line.# 1 -  -
         then
       then
       " Band:"  line.#   0 n>s  "cat                                  1326
       "  [ " "cat    b.p.s  3  n>s  "cat
       "  ]" "cat
       \ "  [" "cat    #.pos float #.fft.pts float / -3 n>s "cat
       \ " ," "cat     #.neg float #.fft.pts float / -3 n>s "cat  " ]"
          "cat
       mkl.bat                                                         1331
       key.done
       world.coords
     plot.bpf&hil  1  =
     if
       ori.t  envelope                                                 1336
            SUB[ 1 , #.FFT.PTS  #.frac / #.frac.2 / ]
            get.x.Time
            take.part
            3 xYDP
     then                                                              1341
     call.lab.amp
     2in1.flag 1 =
     if
     else
       end.gr.out                                                      1346
     then
   else
     \ my.pause
     \ gd
\ %%    hp                                                             1351
     hp.new
     pha&fre.mod
   then
;
                                                                       1356
: gen.mod     \
  eps.flag  1  =
  if
\   sd
```



```
     ibm.graphics     \ device.init  \ Don't use init                  1361
     def.vuport
   else
     \
   then
                                                                       1366
   cr ." [1:Color, 2:file, 3:chan, 4:peak, 5:mode -- ]"
   mod.flag  ":=
   peak.flag  :=
   channel.#  :=
   tmp.s     ":=                                                       1371
   line.#     :=
   tmp.s  n.str1     ":=

   pha.or.amp  " a"  "=
   if                                                                  1376
\    n.str1  7 "left   channel.#  0 n>s  "cat  " .a" "cat
\    peak.flag 0  n>s "cat
\    "dup  cdf.now.str  "swap "cat  ps.file.name ":=
\    file.name.ary "[ 7 ]  ":=
     n.str1  " .a" "cat channel.#  0 n>s  "cat                         1381
     peak.flag 0  n>s "cat
     "dup  cdf.now.str  "swap "cat  ps.file.name ":=
     file.name.ary "[ 7 ]  ":=
   then
                                                                       1386
   set.bpf
\  0  plot.bpf&hil  :=
   1  #.frac.2 :=

   line.#  tmp.s channel.# #.fft.pts  m.s.freq  #.wei  band.start.hil   1391
     gen.h.t
   drop  \ still, there is unsolved garbage on stack
;

\ ------------------------------------------------------------------
\ 1  " a0m1020"  channel.#  #.fft.pts  m.s.freq  #.wei  band.start.hil  1396
   gen.h.t
\ ------------------------------------------------------------------
\ ------------------------------------------------------------------
\ ------------------------------------------------------------------
integer  scalar c.num1
                                                                       1401
\ dir.lee.txt  " test-hil.txt"  defer>  load

\ ==================================================================
\ ==================================================================
0  spe.bpf.flag :=                                                     1406
integer scalar graph.#
cdtNow load take-f-n.asy
: ptof.bat.new  \ [ " file.ext" - ]
  eps.flag 1 =  not
  if                                                                   1411
\ %%  hp  cdf.now.str  "swap  "cat  defer>  vup>pcx
    hp.new  cdf.now.str  "swap  "cat  defer>  vup>pcx
```

```
  then
;
: ato123.bat.ini.bat.all  \ ini 123.file.name.1 & 2
  n.str1  4  "left
  n.str1  6  "left  1 "right   "cat
  c.num1 0 n>s  "cat

  pha.or.amp  " p"  "=
  if
        " f.wks" "cat  ato123.bat.ini.bat.1
  else
    "dup  " a.wks" "cat  ato123.bat.ini.bat.1
        " e.wks" "cat  ato123.bat.ini.bat.2
  then

;

real dim[ 6 ] array sum.p.pos
     dim[ 6 ] array sum.p.neg
     dim[ 6 ] array sum.m.slo
real dim[ 6 , 30 ] array p.pos.2d
     dim[ 6 , 30 ] array p.neg.2d
     dim[ 6 , 30 ] array m.slo.2d
1  integer scalar #.graph
  0. sum.p.pos :=
  0. sum.p.neg :=
  0. sum.m.slo :=

: do.sum \ Summation for multi-segment, graph.#: segment
  line.# 1 +  1   \ Line.# and i: band
  do
    sum.p.pos [ i ]  p.pos [ i ]  +  sum.p.pos [ i ] :=
    sum.p.neg [ i ]  p.neg [ i ]  +  sum.p.neg [ i ] :=
    sum.m.slo [ i ]  m.slo [ i ]  +  sum.m.slo [ i ] :=

    p.pos [ i ]  p.pos.2d [ i ,    graph.#  1 - #.graph -  ] :=
    p.neg [ i ]  p.neg.2d [ i ,    graph.#  1 - #.graph -  ] :=
    m.slo [ i ]  m.slo.2d [ i ,    graph.#  1 - #.graph -  ] :=
  loop
;

: loop.gen.mod
  "dup
       take.f.n.p1.s  n.str1  ":=
       take.f.n.p2.n  c.num1   :=

  n.str1 "upper n.str1 ":=
  n.str1 4 "left 2 "right wave.type.str ":=

  ato123.bat.ini.bat.all
  0     col.beg  :=
  1     row.beg  :=
  0     col.beg.2  :=
  1     row.beg.2  :=
```



```
  plot.bpf&hil  1 =
  if
    1
  else
    wave.type.str " M1" "= if 5 then
    wave.type.str " M2" "= if 4 then
    wave.type.str " M3" "= if 4 then
    wave.type.str " M4" "= if 3 then
    wave.type.str " W4" "= if 4 then
    wave.type.str " W5" "= if 4 then
    wave.type.str " W6" "= if 4 then
  then
  1 +   1
  do \ channel: c.num1, band: i
    i    n.str1  c.num1      i   pha.or.amp    gen.mod
  loop
  eps.flag  1 =  not
  if
    gp.name
    graph.# 0 n>s  "cat  " .pcx"  "cat   ptof.bat.new
    \ graph.# 0 n>s   " .pcx"  "cat   ptof.bat.new
  then
  graph.# 1 +  graph.#  :=

  \  pha.or.amp "upper  " A"  "=
  pha.or.amp   " a"  "=
  if
    do.sum
  then
  \  my.pause
;

: get.s.freq.ori
  "dup
  " ." "swap "within ?drop 1 - "left " .dat" "cat
  "dup tmp.s ":=
  dir.lee.dat "swap "cat defer> file.open
  1 subfile file>unnamed.array [ 3 ] s.freq :=  file.close
  s.freq s.freq.ori :=
  m.s.freq.flag 1 =
  if
  else
    s.freq m.s.freq :=
  then
  \ ======================================== -
  x.beg  0 >
  if
  else
    0.  x.beg :=
  then
  \ ---------------------------------------- -
  x.end
  #.fft.pts 1 - float   m.s.freq float  /
  <
```

```
  if
  else
    #.fft.pts 1 - float    m.s.freq float  /                          1526
    x.end :=
  then
;
\ ================================================================
: lgm                                                                 1531
 loop.gen.mod
;
1 graph.#  :=
: set.mod.reset
  get.p.inc                                                           1536
  7 2       fix.format
   3  2   goto.xy  ." x.beg (Plot range)" x.beg get.val x.beg :=
   3  3   goto.xy  ." x.end (Plot range)" x.end get.val x.end :=
\    40 2  goto.xy  ." pt.beg (Input data range)" pt.beg get.val pt.beg
   :=
  4 0       fix.format                                                1541
   3  4   goto.xy  ." hil.flag (Minimax flag)" hil.flag get.val hil.flag
      :=
   40 4   goto.xy  ." #.wei" #.wei get.val #.wei :=
   3  5   goto.xy  ." #.fft.pts" #.fft.pts get.val #.fft.pts :=
   40 5   goto.xy  ." pt.beg (Data range)" pt.beg get.val pt.beg :=
   \ 67 5  goto.xy  ." smo.flag" smo.flag get.val smo.flag :=          1546
   3  6   goto.xy  ." smo.flag" smo.flag get.val smo.flag :=
   40 6   goto.xy  ." Window (x,k,b,n,m):" wnd.str   get.str  wnd.str
        ":=
   3  7   goto.xy  ." s.freq (Modified)" m.s.freq get.val m.s.freq :=
   40 7   goto.xy  ." s.freq (Ori)" s.freq.ori get.val s.freq.ori :=
   56 7   goto.xy  ." (" tmp.s s.type.2 ." )"                         1551
   70 7   goto.xy  ." p.inc" p.inc get.val p.inc :=

   3  8   goto.xy  ." Fre(p) or Amp(a):" pha.or.amp  get.str  pha.or.amp
     ":=
   3  10 goto.xy  ." Initial plot number:" graph.#  get.val  graph.#
         :=
   \  1  ord.flag  :=  \ \\ this is system default value               1556
   3  11 goto.xy  ." Set derivative order: (for amp slope)"  ord.flag
      get.val ord.flag    :=
   3  12 goto.xy  ." Example:"  " '' f1w6020.1''  loop.gen.mod (lgm)"
      s.type
   2  14 goto.xy   " Press F-key to reenter" s.type.2
  pckey  drop if myself then
;                                                                     1561
: set.mod
  get.p.inc
  sc
  \ \  {show.wnd.s} {border}
  bg.color   background                                               1566
  14         foreground
  \ sd
  sc
  {border}
  7 2       fix.format                                                1571
```



```
   3  2   goto.xy  ." x.beg (Plot range)" x.beg n.type
   3  3   goto.xy  ." x.end (Plot range)" x.end n.type
  4 0       fix.format
   3  4   goto.xy  ." hil.flag (Minimax flag)" hil.flag n.type
   40 4   goto.xy  ." #.wei" #.wei n.type                             1576
   3  5   goto.xy  ." #.fft.pts" #.fft.pts n.type
   40 5   goto.xy  ." pt.beg (Data range)" pt.beg n.type
   \ 67 5  goto.xy  ." smo.flag" smo.flag n.type
   3  6   goto.xy  ." smo.flag" smo.flag n.type
   40 6   goto.xy  ." Window (x,k,b,n,m):" wnd.str   s.type            1581
   3  7   goto.xy  ." s.freq (Modified)" m.s.freq n.type
   40 7   goto.xy  ." s.freq (Ori)" s.freq.ori n.type
   56 7   goto.xy  ." (" tmp.s s.type.2 ." )"
   70 7   goto.xy  ." p.inc" p.inc n.type
                                                                      1586
   3  8   goto.xy  ." Fre(p) or Amp(a):" pha.or.amp  s.type
  4 0       fix.format
   3  10 goto.xy  ." Initial plot number:" graph.#  n.type
   \  1  ord.flag  :=  \ \\ this is system default value
   3  11 goto.xy  ." Set derivative order: (for amp slope)"  ord.flag   1591
      n.type
   3  12 goto.xy  ." Example:"  " '' f1w6020.1''  loop.gen.mod (lgm)"
      s.type
   2  14 goto.xy   " Press F-key to reenter" s.type.2
  non.stop.flag 1 =
  if
    exit                                                              1596
  then
  pckey  drop
  if
    set.mod.reset
  then                                                                1601
  get.p.inc
;
\ ================================================================
: do.fm.bat
  \ get.s.freq.ori                                                    1606
  set.lc
  " p"  pha.or.amp  ":=
  file.name.ary "[ 7 ]  ":=
  \ " b0w4020.4"   file.name.ary "[ 7 ]  ":=
  ibm.graphics    \ device.init  \ Don't use init                     1611
  def.vuport
  ato123.bat.ini.bat.all
  int.flag 1 =
  if
  else                                                                1616
\    cr cr cda.str
    cr cr cdf.now.str
    file.name.ary "[ 7 ]  7 "left   "cat  " .f" "cat
    file.name.ary "[ 7 ]  "len  "drop
    " ."    file.name.ary "[ 7 ]  "within    if then                  1621
    swap  -
    file.name.ary "[ 7 ]   "right   "cat
    "dup  ps.file.name  ":=
```

```
    defer> ps.file
  then                                                                  1626

  ini.gr.out
  \  " b0w4020.4"  lgm
  file.name.ary "[ 7 ]   lgm
  end.gr.out                                                            1631
  ibm.graphics  \ %
  def.vuport
;
: do.am.bat
  \ get.s.freq.ori                                                      1636
  set.lc
  " a"  pha.or.amp  ":=
  file.name.ary "[ 7 ]  ":=
  ato123.bat.ini.bat.all
  \  0 int.flag :=                                                     1641
  \  0 eps.flag :=
  \  0 2in1.flag :=
  file.name.ary "[ 7 ]   lgm
  \  " b0w4020.4"  lgm
  ibm.graphics  \ %                                                     1646
  def.vuport
;
: do.am.fm.bat
  \ pha.or.amp "upper " A" "=
  pha.or.amp " a" "=                                                    1651
  if do.am.bat then
  \ pha.or.amp "upper " P" "=
  pha.or.amp " p" "=
  if do.fm.bat then
;                                                                       1656
\ \ ------------------------------------------------------------------
\ ==================================================================
\ 12 string gp.name
1  string rain.flag
  0. sum.p.pos :=                                                       1661
  0. sum.p.neg :=
  0. sum.m.slo :=
real dim[ 6 ] array dev.p.pos
     dim[ 6 ] array dev.p.neg
     dim[ 6 ] array dev.m.slo                                           1666

: sta.to123
  line.# 1 +  1   \ i: # of bands, graph.#: segment
  do
    sum.p.pos [ i ]  graph.#  1 - #.graph - float /  sum.p.pos [ i ] :=  1671
    sum.p.neg [ i ]  graph.#  1 - #.graph - float /  sum.p.neg [ i ] :=
    sum.m.slo [ i ]  graph.#  1 - #.graph - float /  sum.m.slo [ i ] :=

    p.pos.2d xsect[ i , ! ] sub[ 1 , graph.#  1 - #.graph - ]
      variance sqrt dev.p.pos [ i ] :=                                  1676
    p.neg.2d xsect[ i , ! ] sub[ 1 , graph.#  1 - #.graph - ]
      variance sqrt dev.p.neg [ i ] :=
    m.slo.2d xsect[ i , ! ] sub[ 1 , graph.#  1 - #.graph - ]
```



```
      variance sqrt dev.m.slo [ i ] :=
  loop                                                                  1681

  " -"    123.ary.s   ":=
  gp.name   " -%pos" "cat 123.ary.s  "[ 1 ]  ":=
  123.ary.s   123.file.name   1     1  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.str                                        1686
  sum.p.pos
  dev.p.pos catenate 123.file.name   11    1  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.num

  gp.name   " -%neg" "cat 123.ary.s  "[ 1 ]  ":=                        1691
  123.ary.s   123.file.name   1     2  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.str
  sum.p.neg
  dev.p.neg catenate 123.file.name   11    2  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.num                                        1696
  gp.name   " -mean slope" "cat 123.ary.s  "[ 1 ]  ":=
  123.ary.s   123.file.name   1     3  gp.flag 1 -  3 *  + " d"
              ato123.bat.new.str
  sum.m.slo
  dev.m.slo catenate 123.file.name   11    3  gp.flag 1 -  3 *  + " d"  1701
              ato123.bat.new.num

  gp.flag 1 +  gp.flag :=
  graph.# 1 -  #.graph :=
  10 5 fix.format                                                       1706
  sd
  sum.p.pos  n.type
  sum.p.neg  n.type
  sum.m.slo  n.type
  dev.p.pos  n.type                                                     1711
  dev.p.neg  n.type
  dev.m.slo  n.type
  0. sum.p.pos :=
  0. sum.p.neg :=
  0. sum.m.slo :=                                                       1716
  0. dev.p.pos :=
  0. dev.p.neg :=
  0. dev.m.slo :=
;
\ ==================================================================   1721
0 non.stop.flag :=
: non.stop.op
  sc {border}
  3  2  goto.xy  ." Non-stop Operation (1:Yes, 0:No):" non.stop.flag
     get.val non.stop.flag :=
;                                                                       1726
\ ------------------------------------------------------------------
: set.eps
  1  eps.flag :=
  \ 0  lc.flag :=
  0  2in1.flag :=                                                      1731
;
: set.mon
```

```
  0  eps.flag :=
  1  lc.flag :=
  1  2in1.flag :=                                                          1736
;
\ ================================================================
\ - \ Slope of Envelope
\ cdtNow load LMod-SF.asy \ FxW6
\ cdtNow load LMod-SB.asy \ Winds                                          1741
\ cdtNow load LMod-SA.asy \ Stokes layout 1
\ cdtNow load LMod-SP.asy \ Stokes layout 2
\ ======================================== -
\ - \ Frequency and Amplitude Modulations
\ cdtNow load LMod-Mz.asy \ Test bad differentitation: LMod-F-bad-diff-    1746
   p0m1-P1&2.asy
\ cdtNow load LMod-MA.asy \ Stokes layout 1
cdtNow load LMod-MP.asy \ Stokes layout 2

.....................................................................................................
```

P300-AUTOEXEC.bat


```
d:\PROGRA~1\NETWOR~1\MCAFEE~2\SCAN.EXE C:\
@IF ERRORLEVEL 1 PAUSE

SET BLASTER=A220 I5 D1 H5 P330 E620 T6
SET SOUND=D:\PROGRA~1\CREATIVE\CTSND
SET MIDI=SYNTH:1 MAP:E MODE:0

SET GMKW5=D:\WPWIN\GMKW
set TEMP=e:\tempkeep
set asyst=c:\ron\asy
set TMP=e:\tempkeep
set lib=d:\fortran\lib
set init=d:\fortran\init
set include=d:\fortran\include
@rem ------------------------------
set asmempath=c:\d_l
set asundo=c:\d_l\undofile.$$$
set asvect=c:\d_l
set asketch=c:\RON\ATOSKH\SUPPORT
set asketchcfg=c:\RON\ATOSKH
@rem ------------------------------
set lex=c:\ron\pctex\spell
@rem ------------------------------
REM - By Windows Setup - set  comspec=e:\4dos\4dos.com
set  comspec=e:\4dos\4dos.com

goto %config%

@rem 1================================================================
:P-asy
@ECHO OFF
LH  c:\windows\COMMAND\doskey
goto end

@rem 1_2==============================================================
:EMS-VCPI
set PATH=C:\WINDOWS;C:\WINDOWS\COMMAND;E:\MSDEV\BIN;"%PATH%"
LH   /L:1,15952 c:\windows\COMMAND\doskey
@rem    LH  /L:1,6384 c:\windows\COMMAND\doskey
@rem    c:\windows\COMMAND\MSCDEX /D:MAXCDDRV
goto end

@rem
   ========================================================================
:end

@rem SET PATH=%PATH%;C:\TEXMF\CWTEX
SET CLASSPATH=C:\WINDOWS\JAVA\CLASSES\MSVRML.ZIP;%CLASSPATH%
@REM Environment Settings For McAfee VirusScan
SET PATH=%PATH%;E:\GSTools\gs5.50;D:\PERL\BIN;c:\ron\pctex\spell;C:\RON\
   atoSKH;C:\ODAPI
```

P300-CONFIG.sys

A01797-20161219-A010 ❖ December 19, 2016 ❖ [Page count: 1]

```
[menu]
menuitem=P-asy
menuitem=EMS-VCPI
menudefault=P-asy,1
menucolor=14,1

[common]
device=c:\scsi\aspi8dos.sys /D
numlock=off
FILES=100
rem  - By Windows 98 Network for LastDrive -
rem  - By Windows 98 Network for LastDrive - lastdrive=z

rem  ------------------------------------------------------------------
[P-asy]
DEVICE=C:\WINDOWS\SETVER.EXE
DEVICE=C:\WINDOWS\HIMEM.SYS /testmem:off
device=C:\WINDOWS\EMM386.EXE
DEVICE=C:\CDPRO\VIDE-CDD.SYS /D:MSCD001
DOS=HIGH,UMB
switches /f/n

rem  ------------------------------------------------------------------
[EMS-VCPI]
DEVICE=c:\windows\HIMEM.SYS /testmem:off
rem - By Windows Setup - DEVICE=C:\windows\EMM386.EXE RAM HIGHSCAN I=B000-
   B7FF WIN=B500-B7FF WIN=CC00-CFFF
device=c:\windows\ramdrive.sys  2048  512  /A
FILES=40
DOS=high,UMB
FCBS=16,0
switches /f/n
DEVICEHIGH /L:1,12048 =c:\windows\SETVER.EXE
rem DEVICEHIGH /L:2,39824 =C:\WINDOWS\COMMAND\DRVSPACE.SYS /MOVE

rem  ------------------------------------------------------------------
[common]
set path=C:\WINDOWS;C:\WINDOWS\COMMAND;C:\DOS;c:\lee\tex\bat;e:\localtexmf\
   miktex\bin;c:\texmf\miktex\bin;c:\windows\system;c:\lee\uti
device=C:\WINDOWS\COMMAND\ANSI.SYS
rem   shell=C:\COMMAND.COM C:\ /e:2048 /p
shell=e:\4dos\4dos.com e:\4dos /E:2048 /P
```

Lee.men

A01798-20161220-A001 ❖ December 20, 2016 ❖ [Page count: 13]

```
echo.off                                                                    1
\ ------------------------------ Lee.men
    -----------------------------------
\ 02/20/94
\ ------------------------------------------------------------------------
\ ---  Asyst Menu for real time experiments sys clear  (c) Lee, Yueon-
    Ron -- \
\                                                                           6
\ Requirements :  1.  Memory allocation sensitive
\                 2.  Overlay files included
\                 3.  Confirm device parameters
\                 4.  Configure system properly
\                 5.  Follow subprogram restrictions                       11
\
\ Keywords     :  1.  Acquisition plus analysis
\                 2.  Acquisition
\                 3.  Analysis
\                 4.  Calibration                                          16
\                 5.  Scrolling of data
\                 6.  Real time foreground and background multitasking
    system
\
\ Copyright    :      By Lee,  Oct, 1990.
                                                                            21
sc  ." --  Y.R. Lee --    "   .date   ." ---------   "    .time
1    29.flag :=   {29.line}
100  system.buffer.size
0  bell.flag :=
1  menu.flag  :=                                                            26
" y"  my.pause.flag ":=
forget.all
my.def.colors
  dir.lee.txt   " bell.txt"      "cat   defer> load
  dir.lee.txt   " def-winn.nam"  "cat   defer> load                         31
  dir.lee.txt   " def-acqn.nam"  "cat   defer> load
  dir.lee.txt   " def-acqs.spe"  "cat   defer> load
  dir.lee.txt   " def-anan.nam"  "cat   defer> load
  dir.lee.txt   " def-ana1.1sp"  "cat   defer> load
                                                                            36
echo.off
stack.reset
\ 7 set.file.parse
\ def.vuport line.edit
integer scalar row.beg                                                      41
        scalar lc.flag
1  row.beg  :=
\ ----------------------- Words for resetting parameter
    --------------------
\
    ---------------------------------------------------------------------------

: reset.par.str                                                             46
```



```
    \  Numbeer specifications
    \         " 12345678901234"
    1         " r.Station.1 ="      #spe.str "[   ]  ":=
    2         " r.Spacing.1 ="      #spe.str "[   ]  ":=
    3         " r.Depth.1   ="      #spe.str "[   ]  ":=                  51
    4         " r.Beg.pnt.1 ="      #spe.str "[   ]  ":=
    5         " r.Station.2 ="      #spe.str "[   ]  ":=
    6         " r.Spacing.2 ="      #spe.str "[   ]  ":=
    7         " r.Depth.2   ="      #spe.str "[   ]  ":=
    8         " r.beg.pnt.2 ="      #spe.str "[   ]  ":=                  56
\   9         " r.fft points="      #spe.str "[   ]  ":=

    9         " PS.#.fft.pts="      #spe.str "[   ]  ":=
    10        " PS.f.beg    ="      #spe.str "[   ]  ":=
    11        " PS.f.end    ="      #spe.str "[   ]  ":=                  61

    12        " #.group     ="      #spe.str "[   ]  ":=
    13        " group.ele.1 ="      #spe.str "[   ]  ":=
    14        " group.ele.2 ="      #spe.str "[   ]  ":=
    15        " Add Chnl    ="      #spe.str "[   ]  ":=                  66
\   15        " Pause Flag  ="      #spe.str "[   ]  ":=
\   15        " Reserved    "       #spe.str "[   ]  ":=
    \  String specifications
    1         " xy.axis(l/o)="      "spe.str "[   ]  ":=
    2         " wnd.str     ="      "spe.str "[   ]  ":=                  71
    3         " offset (y/n)="      "spe.str "[   ]  ":=
    4         " y.lab  (n/e)="      "spe.str "[   ]  ":=
    5         " H.copy (y/n)="      "spe.str "[   ]  ":=
    6         " Make ASCII  ="      "spe.str "[   ]  ":=
    7         " View data   ="      "spe.str "[   ]  ":=                  76
    8         " Print OnSite="      "spe.str "[   ]  ":=
    9         " Forced spe  ="      "spe.str "[   ]  ":=
    10        " Pause Flag  ="      "spe.str "[   ]  ":=
    11        " LC flag     ="      "spe.str "[   ]  ":=
    12        " Grid flag   ="      "spe.str "[   ]  ":=                  81
;

: c>"a   \  [ "ele , array ]
   \  1  #spe.str "[ ]  ":=
   "[ ]  ":=                                                              86
;
: "a>c     \  [ ele.# , "array , offset ]  "array>comment
   \ function    \  #spe.str "[  1 ]              1 >comment
                 \  1  #spe.str "[ ]  ":=
   swap                                                                   91
   dup
   "[ ]
   +
   >comment
;                                                                         96
: create.ini.par.file
   regular.datafile
   file.template
     60 comments
     real dim[ #.#spe ] subfile                                          101
```

```
  end
  \  dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.create
  \  dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.open
    spe.str                          defer>  file.create
    spe.str                          defer>  file.open                106
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  #spe.str  0  "a>c
      tmp.v.i  #.#spe  =                                               111
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe.str  20 "a>c                                       116
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=                                        121
      tmp.v.i  "spe      40 "a>c
      tmp.v.i  #.#spe  =
    until
  1 subfile  #spe    array>file
  file.close                                                           126
;
dir.lee.txt  " lspe-acq.dat"  "cat
get.par.file  my.pause
recover.par.acq
                                                                       131
dir.lee.txt  " lspe-ana.dat"  "cat    \ spe.str
get.par.file  my.pause
reset.par.str          \ needed when first change
create.ini.par.file    \ needed when first change
\                                                                      136
   ------------------------------------------------------------------------

\ nd
\ ------------------------------------ Colon Defs FOR MENU
   -------------------
integer  scalar  ana.flag
: run.acq
  {29.line}                                                            141
  dir.lee.txt     " acq.men"     "cat defer> load
  stack.clear
;
: run.dma
  {29.line}                                                            146
  dir.lee.txt     " dma.men"     "cat defer> load
  stack.clear
;
: run.dma.or.acq
  {29.line}                                                            151
  dma.or.sync "upper  " D"  "=
  if
```



```
    dir.lee.txt     " dma.men"     "cat defer> load
  else
    dir.lee.txt     " acq.men"     "cat defer> load                  156
  then
  stack.clear
;
: run.a+a
  nd                                                                   161
  2 0 fix.format
  "  Use ANA menu (1, 2, 3, ..., 9:all) when analyzed? "
  s.type   2  get.val  ana.flag :=
  {29.line}
                                                                       166
  \  dir.lee.txt     " acq.men"     "cat defer> load

  " y"  non.stop.str  ":=
  ana.flag
  case                                                                 171
    1  of  dir.lee.txt     " lsta-0.txt"     "cat defer> load   endof
    2  of  dir.lee.txt     " lref-0.txt"     "cat defer> load   endof
    3  of  dir.lee.txt     " lwhp-0.txt"     "cat defer> load   endof
    4  of  dir.lee.txt     " lplt-0.txt"     "cat defer> load   endof
    5  of  dir.lee.txt     " lsta-0.txt"     "cat defer> load   endof  176
    9  of  dir.lee.txt     " lsta-0.txt"     "cat defer> load
           dir.lee.txt     " lref-0.txt"     "cat defer> load   endof
  endcase
  " n" non.stop.str  ":=
  stack.clear                                                          181
;
: run.mon
  {29.line}
  dir.lee.txt     " mon.men"     "cat defer> load
  stack.clear                                                          186
;
: run.cal
  {29.line}
  dir.lee.txt     " cal.men"     "cat defer> load
  cr .time                                                             191
  stack.clear
;
: run.sta
  {29.line}
  \ sd                                                                 196
  \ echo.on
  " n"  non.stop.str  ":=
  " n"  scr.str       ":=
  0  eps.flag :=
  dir.lee.txt     " lsta-0.txt"     "cat defer> load                   201
  stack.clear
;
: run.sta.e
  {29.line}
  " n"  non.stop.str  ":=                                              206
  " n"  scr.str       ":=
  1  eps.flag :=
```

```
  0 lc.flag  :=
  dir.lee.txt      " lsta-0.txt"      "cat defer> load
  stack.clear                                                    211
;

: run.ref
  {29.line}
  dir.lee.txt      " lref-0.txt"      "cat defer> load           216
  nd
  stack.clear
;
: run.whp
  {29.line}                                                      221
  cr.str   " >"   "= not
  if  else
  dir.lee.txt      " lwhp-0.txt"      "cat defer> load
  then
  nd                                                             226
  stack.clear
;
: run.plt
  {29.line}
  0 eps.flag :=                                                  231
  dir.lee.txt      " lplt-0.txt"      "cat defer> load
  nd
  stack.clear
;
: run.plt.e                                                      236
  {29.line}
  1 eps.flag :=
  0 lc.flag  :=
  dir.lee.txt      " lplt-0.txt"      "cat defer> load
  nd                                                             241
  stack.clear
;
: run.stas
  {29.line}
  " n"  non.stop.str   ":=                                       246
  " y"  scr.str        ":=
  dir.lee.txt      " lsta-0.txt"      "cat defer> load
  stack.clear
;
: run.scr                                                        251
  run.stas
;
\ integer scalar eps.flag
: rf1      0 eps.flag :=  run.sta  ;
: rf1.eps  1 eps.flag :=  run.sta.e  ;                           256
: rf2  run.ref  ;
: rf3  run.whp  ;
: rf4      0 eps.flag :=  run.plt  ;
: rf4.eps  1 eps.flag :=  run.plt.e  ;
: rf5  run.stas ;                                                261
: lacq-spe ;  \ dummy
: run.spe
```



```
  {29.line}
  dir.lee.txt      " lacq-spe.men"      "cat defer> load
  cr .time                                                       266
  forget lacq-spe
  stack.clear
;
\
   ^*************************************************************************

: sta.hlp                                                        271
  dir.lee.txt  " lsta.hlp"  "cat  defer> load
;
: plt.hlp
  dir.lee.txt  " lplt.hlp"  "cat  defer> load
;                                                                276
: scr.hlp
  dir.lee.txt  " lscr.hlp"  "cat  defer> load
;
: ref.hlp
  dir.lee.txt  " lref.hlp"  "cat  defer> load                    281
;
: kr.hlp
  dir.lee.txt  " lref.hlp"  "cat  defer> load
;
: whp.hlp                                                        286
  dir.lee.txt  " lwhp.hlp"  "cat  defer> load
;
: par.hlp
  dir.lee.txt  " lpar.hlp"  "cat  defer> load
;                                                                291
: let.hlp
  dir.lee.txt  " llet.hlp"  "cat  defer> load
;
: cal.hlp
  dir.lee.txt  " lcal.hlp"  "cat  defer> load                    296
;
: acq.hlp
  dir.lee.txt  " lacq.hlp"  "cat  defer> load
;
: a&a.hlp                                                        301
  dir.lee.txt  " LAnA.hlp"  "cat  defer> load
;
: mon.hlp
  dir.lee.txt  " lmon.hlp"  "cat  defer> load
;                                                                306

\ ----------------------- Words for resetting parameter
   --------------------
: get.#spe.ini
  10  3 fix.format
  0  tmp.v.i  :=                                                 311
  begin
    tmp.v.i  1 +   tmp.v.i :=
    tmp.v.i  col.1.pos  col.1.w 1 + + over  row.beg +  goto.xy #spe swap
        [ ] .
```

```
    #spe.str  "[ tmp.v.i 1 + ]  "null    "=
  until                                                                  316
  \  21  3  goto.xy  #spe [ 1 ]  .
;
: get."spe.ini
  0  tmp.v.i  :=
  begin                                                                  321
    tmp.v.i  1 +   tmp.v.i :=
    tmp.v.i  col.2.pos  col.2.w 1 + + over row.beg + goto.xy "spe "[ ]
       "type
    "spe.str "[ tmp.v.i 1 + ]  "null  "=
  until
;                                                                        326
: get."spe.p1   \  [ ele.# - ]
  10  foreground
  10 3 fix.format
  tmp.v.i.2  :=
  tmp.v.i.2                                                              331
  17  col.2.pos +  tmp.v.i.2 row.beg +  goto.xy  "spe "[ tmp.v.i.2 ]
     get.str
                                                "spe "[ tmp.v.i.2 ] ":=
  my.def.colors
;
: get.#spe.p1   \  [ ele.# - ]                                           336
  10  foreground
  10 3 fix.format
  tmp.v.i.2  :=
  tmp.v.i.2
  28  tmp.v.i.2 row.beg +  goto.xy  #spe [ tmp.v.i.2 ] get.val           341
                                    #spe [ tmp.v.i.2 ] :=
                                    my.def.colors
;
: get.#spe.1     1  get.#spe.p1  ;
: get.#spe.2     2  get.#spe.p1  ;                                       346
: get.#spe.3     3  get.#spe.p1  ;
: get.#spe.4     4  get.#spe.p1  ;
: get.#spe.5     5  get.#spe.p1  ;
: get.#spe.6     6  get.#spe.p1  ;
: get.#spe.7     7  get.#spe.p1  ;                                       351
: get.#spe.8     8  get.#spe.p1  ;
: get.#spe.9     9  get.#spe.p1  ;
: get.#spe.10    10 get.#spe.p1  ;
: get.#spe.11    11 get.#spe.p1  ;
: get.#spe.12    12 get.#spe.p1  ;                                       356
: get.#spe.13    13 get.#spe.p1  ;
: get.#spe.14    14 get.#spe.p1  ;
: get.#spe.15    15 get.#spe.p1  ;

: get."spe.1     1  get."spe.p1  ;                                       361
: get."spe.2     2  get."spe.p1  ;
: get."spe.3     3  get."spe.p1  ;
: get."spe.4     4  get."spe.p1  ;
: get."spe.5     5  get."spe.p1  ;
: get."spe.6     6  get."spe.p1  ;                                       366
: get."spe.7     7  get."spe.p1  ;
```



```
: get."spe.8     8  get."spe.p1  ;
: get."spe.9     9  get."spe.p1  ;
: get."spe.10    10 get."spe.p1  ;
: get."spe.11    11 get."spe.p1  ;                                       371
: get."spe.12    12 get."spe.p1  ;

\ ============================================================
: create.lspe.dat
  regular.datafile                                                       376
  file.template
    60 comments
    real dim[ #.#spe ] subfile
  end
  spe.str                              defer>  file.create               381
  spe.str                              defer>  file.open
\  dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.create
\  dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.open
    0  tmp.v.i  :=
    begin                                                                386
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  #spe.str  0  "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=                                                       391
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe.str  20 "a>c
      tmp.v.i  #.#spe  =
    until                                                                396
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe      40 "a>c
      tmp.v.i  #.#spe  =                                                 401
    until
  1 subfile  #spe    array>file
  file.close
;
: done                                                                   406
    create.lspe.dat
    \    #.#spe 2 + 1 +    col.1.pos  7 + goto.xy
    \    ."  lspe-ana data file created : "
    \ ."  OK?"  spe.str       get.str   spe.str  ":=
    spe.str       get.str   spe.str  ":=                                 411
    stack.clear
;
\ ------------------------- Declaration of Menus
   ------------------------------!
Menu Main.Menu
\ ------------------------- Declaration of Menus                         416
   ------------------------------!
Menu par.menu
Menu hlp.Menu
Menu acq.Menu
Menu ana.Menu
```

```
Menu a+a.Menu                                                          421
Menu cal.Menu
Menu scr.Menu

\ -------------------------- Declaration of Vuports
   ----------------------------!
Vuport Bottom                                                          426
\ -------------------------- MENU STATUS WORDS
   ---------------------------------!
: Main.status              \ For menu.status on Main.menu
    0  background
    3  foreground
    3   0 +  4  goto.xy  ."         F6"                               431
    19  0 +  4  goto.xy  ."         F1"
    19  0 +  5  goto.xy  ."         F2"
    19  0 +  6  goto.xy  ."         F3"
    19  0 +  7  goto.xy  ."         F4"
    19  0 +  8  goto.xy  ."         F5"                               436
    35  0 +  4  goto.xy  ."         F7"
    50  0 +  4  goto.xy  ."         F8"
    65  0 +  4  goto.xy  ."         F9"
    2  11 goto.xy ." Press"  b.t  ."  <F10> "  b.t  ." for help"
    2  12 goto.xy ." Press"  b.t  ."  ARROW "  b.t  ." key to choose an   441
       item"
    2  13 goto.xy ." Press"  b.t  ."   ESC  "  b.t  ." key to  exit any
       menu"
    43 12 goto.xy ."          " ." Log in Time : "  .time
    43 13 goto.xy ."          "  " Y.R. Lee"  s.type ."  / 1990, 94, 96"
\   55 11 goto.xy ." Y.R. Lee / Oct. 22 1990"
\   43 11 goto.xy " Developed : Y.R. Lee"  s.type ."  / Oct. 22 1990"    446
    0  background         \ menu.color
    10 foreground
;
: par.status               \ For menu.status on Main.menu
    1  background                                                      451
    3  foreground
    get.#spe.ini
    get."spe.ini
    col.1.pos  7 +     #.#spe  row.beg + 2 -   goto.xy
    \    ."   lspe-ana data file created : "                           456
    \  " Resetting  " dir.lee.txt " lspe-ana.dat" "cat  "cat  "type
    spe.str                                              "type
    2  19 goto.xy ." Press"  b.t  ."  <F10> "  b.t  ." for help"
    2  20 goto.xy ." Press"  b.t  ."  ARROW "  b.t  ." key to choose an
       item"
    2  21 goto.xy ." Press"  b.t  ."   ESC  "  b.t  ." key to  exit any   461
       menu"
    43 21 goto.xy ."           " " Y.R. Lee"  s.type ."  / 1990, 94"
    1  background
    13 foreground
;
: hlp.status                                                           466
    5   background
    3   foreground
    1 0 goto.xy   ." <Enter> key to choose an item"
```



```
    1 1 goto.xy   ." <Esc> key to escape current menu"
    1 2 goto.xy   ." Choose an item: "                                 471
    5   background
    0   foreground
;
\
   ------------------------------------------------------------------------

par.menu                                                               476
    cdt
    Menu.Store.Disk
    Menu.status par.status
    Menu.no.protect
    " Reset Parameters ---  " "date  "cat    MENU.TITLE                481
    \    Menu.Pull.Down
    Menu.blow.up
    1 1 23 79                                    MENU.SHAPE
    1  13                                        MENU.COLOR
    14                                           Menu.Prompt.Color         486
    \ 4                                            Menu.Prompt.Color
    1  row.beg + col.1.pos  #spe.str  "[  1 ]   MENU.ITEM{ get.#spe.1  }
    2  row.beg + col.1.pos  #spe.str  "[  2 ]   MENU.ITEM{ get.#spe.2  }
    3  row.beg + col.1.pos  #spe.str  "[  3 ]   MENU.ITEM{ get.#spe.3  }
    4  row.beg + col.1.pos  #spe.str  "[  4 ]   MENU.ITEM{ get.#spe.4  }  491
    5  row.beg + col.1.pos  #spe.str  "[  5 ]   MENU.ITEM{ get.#spe.5  }
    6  row.beg + col.1.pos  #spe.str  "[  6 ]   MENU.ITEM{ get.#spe.6  }
    7  row.beg + col.1.pos  #spe.str  "[  7 ]   MENU.ITEM{ get.#spe.7  }
    8  row.beg + col.1.pos  #spe.str  "[  8 ]   MENU.ITEM{ get.#spe.8  }
    9  row.beg + col.1.pos  #spe.str  "[  9 ]   MENU.ITEM{ get.#spe.9  }  496
    10 row.beg + col.1.pos  #spe.str  "[ 10 ]   MENU.ITEM{ get.#spe.10 }
    11 row.beg + col.1.pos  #spe.str  "[ 11 ]   MENU.ITEM{ get.#spe.11 }
    12 row.beg + col.1.pos  #spe.str  "[ 12 ]   MENU.ITEM{ get.#spe.12 }
    13 row.beg + col.1.pos  #spe.str  "[ 13 ]   MENU.ITEM{ get.#spe.13 }
    14 row.beg + col.1.pos  #spe.str  "[ 14 ]   MENU.ITEM{ get.#spe.14 }  501
    15 row.beg + col.1.pos  #spe.str  "[ 15 ]   MENU.ITEM{ get.#spe.15 }

    1  row.beg + col.2.pos  "spe.str  "[  1 ]   MENU.ITEM{ get."spe.1  }
    2  row.beg + col.2.pos  "spe.str  "[  2 ]   MENU.ITEM{ get."spe.2  }
    3  row.beg + col.2.pos  "spe.str  "[  3 ]   MENU.ITEM{ get."spe.3  }  506
    4  row.beg + col.2.pos  "spe.str  "[  4 ]   MENU.ITEM{ get."spe.4  }
    5  row.beg + col.2.pos  "spe.str  "[  5 ]   MENU.ITEM{ get."spe.5  }
    6  row.beg + col.2.pos  "spe.str  "[  6 ]   MENU.ITEM{ get."spe.6  }
    7  row.beg + col.2.pos  "spe.str  "[  7 ]   MENU.ITEM{ get."spe.7  }
    8  row.beg + col.2.pos  "spe.str  "[  8 ]   MENU.ITEM{ get."spe.8  }  511
    9  row.beg + col.2.pos  "spe.str  "[  9 ]   MENU.ITEM{ get."spe.9  }
    10 row.beg + col.2.pos  "spe.str  "[ 10 ]   MENU.ITEM{ get."spe.10 }
    11 row.beg + col.2.pos  "spe.str  "[ 11 ]   MENU.ITEM{ get."spe.11 }
    12 row.beg + col.2.pos  "spe.str  "[ 12 ]   MENU.ITEM{ get."spe.12 }
                                                                          516
\   #.#spe row.beg + 1 +    col.1.pos  3 -  " Done?"   menu.item{ done }
    #.#spe row.beg + 2 -    col.1.pos  3 -  " Done?"   menu.item{ done }
\          row.beg   1 -    col.1.pos  3 -  " Done?"   menu.item{ done }

MENU.END                                                               521
```

```
: acq.status            \ For menu.status on Main.menu
    3   background
    0   foreground
    1  0  goto.xy ." Choose an item:"                                  526
    1  11 goto.xy ." Press" b.t ."  F10 " b.t ." for help"
    3   background
    4   foreground
;                                                                     531
: ana.status            \ For menu.status on Main.menu
    3   background
    0   foreground
    1  0  goto.xy ." Choose an item:"
    1  11 goto.xy ." Press" b.t ."  F10 " b.t ." for help"            536
    3   background
    4   foreground
;

\ ------------------------------ MENUS                                541
  ---------------------------------------!
acq.MENU
    cdt
    Menu.Store.Disk
    "  ACQ "                                    Menu.Title
    menu.status acq.status                                            546
    \ Menu.Pop.UP
    Menu.blow.UP
    7   5  12  42                                Menu.Shape
    3  4                                         Menu.Color
    14                                           Menu.Prompt.Color    551
    1 2 " 1. Multitasking mode (better sync)"    Menu.Item{ run.acq }
    2 2 " 2. DMA mode (for huge & fast ACQ)"     Menu.Item{ run.dma }
MENU.END
ana.MENU
    cdt                                                               556
    Menu.Store.Disk
    "  ANA "                                      Menu.Title
    menu.status ana.status
    \ Menu.Pop.UP
    Menu.blow.UP                                                      561
    7  16  18  49                                 Menu.Shape
    3  4                                          Menu.Color
    14                                            Menu.Prompt.Color
    1 2 " 1. Spectra & Statisitcs"               Menu.Item{ rf1 } \
        run.sta
\   2 2 " 2. Wave Form Analysis (and Kr)"        Menu.Item{ rf2 } \    566
   run.ref
    2 2 " 2. Wave Sta, Kr, IR seperation"        Menu.Item{ rf2 } \
        run.ref
\   3 2 " 3. Distribution Curves"                Menu.Item{ rf3 } \
   run.whp
    3 2 " 3. [Distribution Curves]"              Menu.Item{ rf3 } \
        run.whp
    4 2 " 4. Flexible Stripe Chart"              Menu.Item{ rf4 } \
        run.plt
```



```
    5 2 " 5. Data Scrolling"                     Menu.Item{ rf5 } \       571
        run.stas
    6 2 " 6. == Reset Parameters =="             Menu.Item{ par.menu } \
    7 2 " 7. [Wavelet Analysis]"                 Menu.Item{ nop      }
    8 2 " 8. [Wavelet&Spectral Coherence]"       Menu.Item{ nop      }
    9 2 " 9. EPS--Flexible Stripe Chart"         Menu.Item{ rf4.eps }
   10 2 " 0. EPS--Spectra & Statisitcs"          Menu.Item{ rf1.eps }     576
\  10 1 " == Reset Acq Parameters =="             Menu.Item{ nop      }
    \ Make prompt color same as foreground because no items are chosen
       here
MENU.END

\ ------------------------- Designing The Main Menu                      581
   ----------------------------!
MAIN.menu
    cdt
    Menu.Store.Disk
    \ Menu.Store.memory
    Menu.status Main.status                                           586
    " REAL TIME SYSTEM   ---  " "date  "cat    MENU.TITLE
    Menu.Pull.Down
    1 1 14 79                                     MENU.SHAPE
    0  10                                         MENU.COLOR
    14                                            Menu.Prompt.Color   591
\   3  3  " ---ACQ---"                           MENU.ITEM{ run.acq }
\   3  3  " ---ACQ---"                           MENU.ITEM{ nop      }
    3  3  " ---ACQ---"                           MENU.ITEM{ acq.menu }
    3  19 " ---ANA---"                           MENU.ITEM{ ana.menu }
    3  35 " -ACQ+ANA-"                           MENU.ITEM{ run.a+a }    596
    3  50 " ---CAL---"                           MENU.ITEM{ run.cal }
    3  65 " ---MON---"                           MENU.ITEM{ run.mon }
\    3  50 " ---CAL---"                           MENU.ITEM{ nop      }
\    3  65 " ---MON---"                           MENU.ITEM{ nop      }
\    2  1  "  ACQ+ANA"                            MENU.ITEM{ run.a+a }    601
\    2  16 "  ACQUISITION"                        MENU.ITEM{ run.acq }
\    2  34 "  ANALYSIS"                           MENU.ITEM{ ana.menu }
\    2  49 "  CALIBRATION"                        MENU.ITEM{ run.cal }
\    2  66 "  SCROLLING"                          MENU.ITEM{ run.scr }
MENU.END                                                              606

Hlp.MENU
    " HELP"                                       Menu.Title
    Menu.status hlp.status
    Menu.Pop.UP                                                       611
\   10 43 22 78                                   Menu.Shape
     8 41 22 77                                   Menu.Shape
\   10  3 22 39                                   Menu.Shape
\    9  3 22 39                                   Menu.Shape
    5  0                                          Menu.color          616
    14                                            Menu.Prompt.Color
\   0 1 " <Enter> key to choose an item"          Menu.Item{ NOP }
\   1 1 " <Esc> key to escape current menu"       Menu.Item{ NOP }
\   2 1 " Choose an item: "                       Menu.Item{ NOP }
    3 3 " -- ACQ --"                              Menu.Item{ acq.hlp }    621
    4 3 " -- ANA & A+A --"                        Menu.Item{ a&a.hlp }
```

```
    5 6 " Spectra & Statisitcs"                  Menu.Item{ sta.hlp }
    6 6 " Wave Sta, Kr, IR seperation"           Menu.Item{ ref.hlp }
    7 6 " Distribution Curves"                   Menu.Item{ whp.hlp }
    8 6 " Flexible Stripe Chart"                 Menu.Item{ plt.hlp }      626
    9 6 " Data Scrolling"                        Menu.Item{ scr.hlp }
   10 6 " == Reset Parameters =="                Menu.Item{ par.hlp }
   11 6 " [Wavelet Analysis]"                    Menu.Item{ let.hlp }
   12 6 " [Wavelet & Spectral Coherence]"        Menu.Item{ let.hlp }
   13 3 " -- CAL --"                             Menu.Item{ cal.hlp }      631
   14 3 " -- MON --"                             Menu.Item{ mon.hlp }
    0 foreground
\   \ Make prompt color same as foreground because no items are chosen
   here
MENU.END
                                                                           636
\ ------------- Assigning Menus & Colon Defs To Function Keys
   -----------------!
  F6   Menu.key.does run.dma.or.acq
\ F3   Menu.key.does run.a+a
  F7   Menu.key.does ana.menu
  F8   Menu.key.does run.cal                                               641
  F9   Menu.key.does run.mon
  F10  Menu.key.does hlp.menu

  F1   menu.key.does rf1
  F2   menu.key.does rf2                                                   646
  F3   menu.key.does rf3
  F4   menu.key.does rf4
  F5   menu.key.does rf5

\ -------------------- Initializing and starting program                  651
   ----------------------!
: Start
    echo.off
    Stack.clear
    Menu.stack.clear            \ Clears all active menus
    Normal.display                                                         656
    Main.menu
    bell.1LL
    menu.execute
    0 menu.flag :=  \ restore
    Normal.display                                                         661
;
bell.1ll
\ cdt load load-eps.txt

start                                                                      666
32000  system.buffer.size
```

ACQ.men

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```
\ ---- plea egula t file  EXP.DATA.ACQUISITION       (c) Lee Yueon-Ron     1
   ------- \

\ REQUIREMENTS : 1.  Memory allo  E.ASC ighly sensitive when incorpered
   into
\                    ANALYSIS program
\                2.  Overlay files included ( Acq , Data, Alg )
\                3.  Overall sampling frequency not to exceed 800 Hz       6
\                4.  System CONFIGURED properly
\                5.  Proper Gain setting
\
\ KEY WORDS    : 1.  Background analog A/D
\                2.  Foreground oscilloscope simulated simultaneous        11
   monitoring
\                3.  Multitasking operations
\                4.  User friendly control and performance
\                5.  Optimized concurrent acquisition for different
   channels
\                6.  Versatile acquisition choices
\                                                                          16
\ HINTS        : 1.  Array   --- DAS  +  Pixel  + Minor
\                        ? *2   8000 *4
\                2.  Token   --- no
\                3.  Unnamed --- minor  ( + ramp for STD )
\                                  1 chnl *4 *2                           21
\                4.  DAS buf --- DAS
\
\ Copyright          May, 1990  by Lee  (02/20/94)

\ 0 set.file.parse                                                         26
echo.off normal.display screen.clear
1 29.flag :=
{29.line}
: forget.word.acq
;                                                                          31

\ dir.lee.txt  " bell.txt"       "cat   defer> load
  dir.lee.txt  " pre-file.nam"   "cat   defer> load
\ dir.lee.txt  " def-winn.nam"   "cat   defer> load
\ dir.lee.txt  " def-acqn.nam"   "cat   defer> load                        36
\ dir.lee.txt  " def-acqs.spe"   "cat   defer> load
\ dir.lee.txt  " def-anan.nam"   "cat   defer> load
\ dir.lee.txt  " def-ana1.1sp"   "cat   defer> load

5   5   19   75  window tmp.wnd  {border}                                  41
2 string drive.str
1 string terminate.str
" f:"    drive.str  ":=
nd
xlyl                                                                       46
dir.lee.txt  " filepass.asy"   "cat    filepass.asy   ":=
: check.file.exist  \  [ "filename.ext,  "dir  -  t/f ]
```



```
  my.def.colors
  chk.file.str  "upper  " Y"  "=   not
  if                                                                       51
    "drop  "drop
    false
    exit
  then
  15 11 goto.xy  b.t  ." ---- Checking existing files. Please wait. ----   56
     "  b.t
  tmp.s.9  ":=
  "upper
  tmp.s.8  ":=
  dir.lee.txt  " dat-file.lst"  "cat  defer> delete
  dir.lee.txt  " dat-file.lst"  "cat  defer> out>file                      61
  console.off
  tmp.s.9   defer>  chdir
  tmp.s.8   defer>
  dir.brief
  out>file.close  console                                                  66
  dir.lee.txt  " dat-file.lst"  "cat  defer> basic.open
  4  0 fix.format
  0  tmp.v.i  :=
  begin
    tmp.v.i 1 +  tmp.v.i  :=                                               71
    ?basic.eof
    if
      basic.close
      false  cdt
      exit                                                                 76
    then
    "basic.read
    tmp.s.8  "len  "drop  "left
    tmp.s.8  "=
    if                                                                     81
      \  cr  ." Got"
      true  cdt
      basic.close
      exit
    then                                                                   86
    ?basic.eof
  until
  basic.close
  false  cdt
  15 11 goto.xy  ."                                          "             91
;

: get.del.time
  0  acq.del  :=
  datafile.dat.p2  del.str.pos  1  "sub   del.str.1  "=                    96
    if  del.time.1          acq.del  :=  then
  datafile.dat.p2  del.str.pos  1  "sub   del.str.2  "=
    if  del.time.2          acq.del  :=  then
  datafile.dat.p2  del.str.pos  1  "sub   del.str.3  "=
    if  del.time.3          acq.del  :=  then                                101
  datafile.dat.p2  del.str.pos  1  "sub   del.str.4  "=
```

```
    if   del.time.4            acq.del  :=  then
;

: get.acq.input                                                          106
  " n"  terminate.str  ":=
  upper.wnd {border}             \ <--
  screen.clear
\  inv.on
\  19 2  goto.xy  ."             WELCOME TO DMA                "   inv.of   111
\  19 2  goto.xy  ."       WELCOME TO MUTITASKING MODE          "   inv.of
  19 2  goto.xy  "       WELCOME TO MUTITASKING MODE          "
    s.type.3
  14 foreground
  19 4  goto.xy  ."  Sampling RATE            :             Hz "
  19 5  goto.xy  ."  Total sampling TIME      :            Sec "          116
\ 19 6  goto.xy  ."  Total sampling channels :         (1~16) "
  19 6  goto.xy  ."  Sampling chan FROM - TO :    ---         "
  19 7  goto.xy  ."  MONITORED  channel       :               "
  19 8  goto.xy  ."  CASE name                :               "
  19 9  goto.xy  ."  DELAY Time               :            Sec "          121
  19 10 goto.xy  ."  Any SPECIFICS            :               "
  em.color foreground
  7  0  fix.format
  46 4  goto.xy    s.freq   get.val  s.freq   :=
  7  3  fix.format                                                       126
  46 5  goto.xy    s.dura   get.val  s.dura   :=
\ 46 6  goto.xy    s.chnls  get.val  s.chnls  :=
  2 0 fix.format
  46 6  goto.xy    chan.beg.#    get.val  chan.beg.#  :=
  51 6  goto.xy    chan.end.#    get.val  chan.end.#  :=                 131
                   chan.end.#  chan.beg.# -  1 +  s.chnls :=
  7  0  fix.format
  46 7  goto.xy    p.chnl   get.val  p.chnl   :=
\ 46 7  goto.xy    p.chnl   get.val  p.chnl   :=
  9  4  fix.format                                                       136
                s.dura  s.freq  *   s.length :=
  46 8  goto.xy    tmp.s  s.type  s.input
  "dup
  "dup  "len  "drop  0  =
  if     tmp.s  datafile.dat.p2  ":=                                    141
  else   "dup   tmp.s  ":=  datafile.dat.p2  ":=
  then
  "len  "drop  0  =  not
  if
    tmp.wnd                                                              146
    datafile.dat.p2  " .dat"  "cat
    dir.lee.dat  "len  1 - "left     check.file.exist
    if
      15 11 goto.xy  ."                                          "
      15 11 goto.xy   " File already exists!!"  s.type                   151
                ."    ( " tmp.s.8 "type ."   at "  tmp.v.i 0 n>s "type
                ." )"
      18 12 goto.xy  ." Please reenter! --- <cr>"
      18 13 goto.xy  ." To overwrite, press <F>!"
      pckey drop  not
```



```
      if                                                                 156
        18 12 goto.xy  ."                                  "
        18 13 goto.xy  ."                                "
        myself
      then
    then                                                                 161
  then
  upper.wnd  {border}
  get.del.time
  7  0  fix.format
  46 9  goto.xy    acq.del  get.val  acq.del  :=                         166
  s.freq  s.dura *  s.chnls *   32000 >
  if
    20   11  goto.xy  b.t  ." ---- You must use DMA Mode A/D. ----"  b.t
    " q" terminate.str ":=
  then                                                                   171

  46 10 goto.xy    tmp.s.2  s.type  s.input
   "dup  "len  "drop  0  =
  if     tmp.s.2  specifics       ":=
  else   "dup   tmp.s.2  ":=  specifics       ":=                        176
  then
  my.def.colors
  3   13  goto.xy
  \  ." Reenter, press <F>;  To continue, press <non-F>; To exit, press
     q."
  ."    Reenter:"          " <F>"       s.type.3                        181
  ."    Continue:"         " <non-F>"   s.type.3
  ."    Exit:"             " <Q>"       s.type.3
  bell.2sl
  \  pckey drop if myself then
  pckey  ?dup                                                            186
  not
  if
    113  =  if  " q" terminate.str ":=           then
  else
  then                                                                   191
  if     myself        then
;
: data.filename.input
  " n"  terminate.str  ":=
  bell.2sl                                                               196
  nd  sc
  tmp.wnd  {border}
  pre.file.name
  my.def.colors
  tmp.wnd  {border}                                                      201
  inv.on
  14 foreground
  4  5  goto.xy  ." Please input CASE name  :          "
  {border}
  31 5  goto.xy                                                          206
  s.input  datafile.dat.p2  ":=
  datafile.dat.p2  " .dat"  "cat
  dir.lee.dat  "len  1 - "left     check.file.exist
```

```
  if
    15 11 goto.xy  ."                                                  "   211
    15 11 goto.xy   " File already exists!!"  s.type
                 ."    ( " tmp.s.8 "type ."   at "  tmp.v.i 0 n>s "type  .
                " )"
    18 12 goto.xy  ." Please reenter! --- <cr>"
    18 13 goto.xy  ." To overwrite, press <F>!"
    pckey drop  not                                                        216
    if
      18 12 goto.xy  ."                              "
      18 13 goto.xy  ."                            "
      myself
    then                                                                   221
  then
  cr
  inv.of
  lower.inner.wnd  {border}  \ <---
  cr                                                                       226
  ."                                    To reenter,  Press <F>."   cr
  ."                                    To continue, Press <cr>."
  bell.2sl
  pckey drop if    myself  then
  get.del.time                                                             231
;

: default.acq.input
  " n"  terminate.str  ":=
  nd      upper.wnd  {border}                                              236
  screen.clear
\  inv.on
\ 19 2  goto.xy  ."            WELCOME TO DMA               "   inv.of
\  19 2  goto.xy  ."       WELCOME TO MUTITASKING MODE       "   inv.of
  19 2  goto.xy  "       WELCOME TO MUTITASKING MODE         "            241
     s.type.3
  14 foreground
  19 4  goto.xy  ."  Sampling RATE           :            Hz "
  19 5  goto.xy  ."  Total sampling TIME     :           Sec "
\ 19 6  goto.xy  ."  Total sampling channels :        (1~16) "
  19 6  goto.xy  ."  Sampling chan FROM - TO :   ---         "            246
  19 7  goto.xy  ."  MONITORED  channel      :               "
  19 8  goto.xy  ."  CASE name               :               "
  19 9  goto.xy  ."  DELAY Time              :           Sec "
  19 10 goto.xy  ."  Any SPECIFICS           :               "
  em.color  foreground                                                     251
  7 0 fix.format
  46 4  goto.xy    s.freq   .
  7  3  fix.format
  46 5  goto.xy    s.dura   .
\ 46 6  goto.xy    s.chnls  .                                              256
  2 0 fix.format
  46 6  goto.xy    chan.beg.# .
  51 6  goto.xy    chan.end.# .    chan.end.#  chan.beg.# -  1 +
     s.chnls :=
  7 0 fix.format
  46 7  goto.xy    p.chnl   .                                              261
```



```
  46 8  goto.xy             datafile.dat.p2  s.type
  46 9  goto.xy    acq.del  . \  "   (1-16)" inv.on  "type inv.of

  s.freq  s.dura *  s.chnls *   32000 >
  if                                                                       266
    20   11  goto.xy  b.t  ." ---- You must use DMA mode A/D. ----"  b.t
    " q" terminate.str ":=
  then
  46 10 goto.xy    s.input  specifics      ":=
  my.def.colors                                                            271

  datafile.dat.p2  tmp.s    ":=
  specifics        tmp.s.2  ":=

  3   12  goto.xy                                                          276
  \ ." To reenter, press <F>;  To continue, press <non-F>; To exit,
     press q."
  ."    Reenter:"          " <F>"      s.type.3
  ."    Continue:"         " <non-F>"  s.type.3
  ."    Exit:"             " <Q>"      s.type.3
  bell.2sl                                                                 281
  pckey  ?dup
  not
  if
    113  =  if   " q" terminate.str ":=       then
  else                                                                     286
  then
  if    get.acq.input  then
;

nd   data.filename.input                                                   291

default.acq.input
lower.wnd {border}
dir.lee.dat  datafile.dat.p2  "cat  " .dat"   "cat  datafile.dat  ":=
                                                                           296
\  80 conversion.delay
1000.  s.freq  float / t.rate :=
s.freq 2 * p.points :=      \ osscilloscope display set to every two
   seconds

1 low.f.modulo   :=                                                        301
: find.t.rate               \ for low frequency acq
  t.rate   53   >
  if
  t.rate       2 /      t.rate       :=
  low.f.modulo 2 *      low.f.modulo  :=                                   306
  t.rate   53   >
    if
      myself
    then
  then                                                                     311
;
find.t.rate
: for.dummy.array
```

```
  s.dura  s.freq  *   s.length :=
  terminate.str  "upper  " Q"  "=                                    316
  if
    1  s.length :=
    1  p.points :=
  then
;                                                                    321
for.dummy.array
\ token db0    \    token db1        token db2
\ exp.mem> db0  \   exp.mem> db1     exp.mem> db2
  integer dim[ s.length , s.chnls ] unnamed.array    becomes> db0
\ integer dim[      p.points      ] unnamed.array    becomes> db1     326
\ integer dim[      p.points      ] unnamed.array    becomes> db2

  INTEGER DIM[ p.points ] ARRAY db1        \ buffer for plotted points
  INTEGER DIM[ p.points ] ARRAY db2
\ integer dim[ s.length , s.chnls ] array db0                        331
                                          \ buffer for raw data

chan.beg.#  1 -    s.chnls 1 -  chan.beg.# + 1 -   a/d.template
   chnls.in
\ s.chnls 1 - 0 swap  A/D.TEMPLATE CHNLs.IN      \ template for input on
db0   TEMPLATE.BUFFER                    \ channels ( 1 --> 16 )     336

\ p.chnl 1 - chan.beg.# + 1 -  dup  A/D.TEMPLATE CHNL.plot    \
   oscilloscope
p.chnl 1 - dup  A/D.TEMPLATE CHNL.plot          \ template for
   oscilloscope
db1  db2  CYCLIC DOUBLE.TEMPLATE.BUFFERS
                                                                     341
: START.ACQ                               \ start acquisition
  \ terminate.str  cr s.type
  \ s.length . ."   "    t.rate .
  \ my.pause
  terminate.str  "upper  " Q"  "=  if exit then                      346
  CLEAR.TASKS

    CHNLs.IN A/D.INIT
    1 TASK A/D.IN>ARRAY
    s.length 1 task.iterations                                       351
    low.f.modulo   1   task.modulo

    chnl.plot a/d.init
    2 task a/d.in>array
    1 2 task.deactivated.by                                          356
    low.f.modulo   2   task.modulo

  T.RATE TASK.period
  PRIME.TASKS
  TRIGGER.TASKS                                                      361
;

: STOP.ACQ                                \ stop acquisition
   STOP.TASKS
   CLEAR.TASKS                                                       366
```



```
;

 REAL DIM[ 3000 ] ARRAY PIXBUF \ pixel buffer to allow fast graphic data
    erase
\ REAL DIM[ 6000 ] ARRAY PIXBUF \ pixel buffer to allow fast graphic
   data erase
                                                                     371
\ token pixbuf
\ exp.mem> pixbuf
\ integer dim[ 10000 ] unnamed.array    becomes> pixbuf

: SET.GRAPHICS                \ setup the graphics scales            376
   0.025 .4  VUPORT.ORIG
   0.95  .45 VUPORT.SIZE       \ where to plot data

   .05 .05  AXIS.ORIG          \ center plotting area of vuport
   .9  .9   AXIS.SIZE                                                381

   10   10  axis.divisions

   HORIZONTAL   NO.LABELS
                grid.on                                              386
   NORMAL.COORDS .5 .5 AXIS.POINT           \ axis in center of vuport
\  0.8   0.1   position    " CHANNEL: "  p.chnl  get.chnl.str "cat label
   0.8   0.1   position    " CHANNEL: "  p.chnl  0  n>s        "cat label
   {29.line}  sc  ." RATE : "  4  0  fix.format s.freq  n.type  ."  Hz"
   ."      Unit: 1V <--> "  v.to.h  5  2  fix.format  n.type           391
   previous.window

   VERTICAL 0 1 LABEL.POINTS                \ plot vertical labels on
      even tick
            grid.on
   HORIZONTAL 0. p.points float WORLD.SET   \ set scales: indices on X  396
   VERTICAL   axis.fit.off
   VERTICAL   gra.lower.lim   gra.upper.lim   WORLD.SET   \  displayed
      on Y

   OUTLINE   \  grid
   XY.AXIS.PLOT                             \ axis and grid lines      401
   \  4096  ---  5V  ----  50cm
   \                      30      4096 * 0.8 = 3276.8
   \
   \                     -30      4096 * 0.2 =  819.2
   \     0  --- -5V  ---- -50cm                                        406
   VERTICAL    \  Reset world for AD Board digital Range
       gain  2. /  vol.lower.lim -  dig.lim  *   gain /   neg  dig.lim +
       gain  2. /  vol.upper.lim -  dig.lim  *   gain /   neg  dig.lim +
   WORLD.SET    \ signal on Y
   10 color                                                          411
   PIXBUF LINE.BUFFER.ON
;

19 5 23 75 WINDOW {PROMPT}                \ window for text prompts
                                                                     416
: PROMPT'EM                               \ put up prompts
```

```
   GRAPHICS.DISPLAY
   SCREEN.CLEAR
   {PROMPT}
   CR  cr                                                              421
   ."              Type any <F> to stop data acquisition" cr  cr
   ."        ______ ACQUIRING  of  "  datafile.dat int.text ."  _____"
   bell.2sl
;                                                                      426

integer scalar  dat.file.flag
1  dat.file.flag  :=

: PLOT.IT   \ loop to plot data,  synchronized to data acquisition
   BEGIN                                                               431
\      ERASE.LINES                  \ erase previous lines

      BEGIN                         \ wait for buffer to fill up
         ?BUFFER.SWITCH
          1  ?task.state  3  =  or                                     436
      UNTIL
      ERASE.LINES                   \ erase previous lines

      ?BUFFER.A/B                   \ choose which buffer to plot
      IF   db1                                                        441
      ELSE db2
      THEN
      Y.DATA.PLOT                   \ plot new data

      1 ?task.state 3 = ?key if pckey drop                            446
                             if  0  dat.file.flag :=   exit then
                          then  False or
    UNTIL
;                                                                     451

: CLEAN.UP                          \ clean up the system state when done
   LINE.BUFFER.OFF
   AXIS.DEFAULTS
   SCREEN.CLEAR \  b.t
   CR ." Data acquisition finished"                                   456
   bell.2sl
;

: DOIT              \ overall functioning
  terminate.str  "upper  " Q"  "=  if exit then                       461
   PROMPT'EM        \ write out prompts
   SET.GRAPHICS     \ Set up graphics area and scaling
   START.ACQ        \ Start up the tasks
   PLOT.IT          \ Plot the data continuously
   STOP.ACQ         \ Stop tasks                                      466
   CLEAN.UP
   \ when.onerr
;

\ ------------------------------------------------------------------  471
: acq.del.tes
```



```
  cr ."          Press " b.t ." <F>" b.t ."      to run  Syncronized
     Acquisition!"
  cr ."          Press " b.t ." <non-F>" b.t ." to run  Delayed
     Acquisition!"
  cr  cr cr  ."       "  .time
  BELL.2sl                                                            476
  pckey not   drop
  if
    \  get.del.time
    \  acq.del.def
    SCREEN.CLEAR                                                      481
    \   cr ."                Delayed  Acquisition !  ---- " acq.del 1000
        /    .
    cr ."               Delayed  Acquisition !  ---- " acq.del    .
    ."  Sec"
  else
    0.  acq.del  :=                                                   486
    SCREEN.CLEAR
    cr ."                Syncronized Acquisition !"
  then
  cr  cr cr  ."       "  .time
;                                                                     491

: acq.del.exe
  terminate.str  "upper  " Q"  "=  if exit then
  acq.del.tes
  acq.del  0  <>                                                      496
  if
    acq.del   tmp.v.i  :=
    50 20 goto.xy   tmp.v.i      .        ."  Sec"
    tmp.v.i  1 +   1
    do                                                                501
      1000  msec.delay
      50 20 goto.xy   tmp.v.i  i -    .
    loop
    bell.2sl
  then                                                                506
  bell.1sl
;
\ b.t
lower.wnd {border} screen.clear  cr  acq.del.exe
doit                                                                  511
\ ------------------------------------------------------------------
normal.display
\ ==================================================================

: get.datafile.dat.p23                                                516
  datafile.dat.p2   " .dat"   "cat   datafile.dat.p23  ":=
;
get.datafile.dat.p23

regular.datafile                                                      521
file.template
   8 comments
   integer dim[ 6 ] subfile
```

```
end
: create.filepass.asy                                                    526
  filepass.asy   defer> file.create
  filepass.asy   defer> file.open
  " Case          :    "  datafile.dat.p23 "cat mycase ":=  mycase      1 >
     comment
  " Date          :    "  "date            "cat mydate ":=  mydate      2 >
     comment
  " Time          :    "  "time            "cat mytime ":=  mytime      3 >  531
     comment
  " Specifics     :    "  specifics "cat  specifics ":=  specifics      4 >
     comment
                                              datafile.dat.p23      5 >
                                                 comment
  t.rate     acq.input   [ 1 ]  :=
  s.length   acq.input   [ 2 ]  :=
  s.freq     acq.input   [ 3 ]  :=                                        536
  s.chnls    acq.input   [ 4 ]  :=
  p.chnl     acq.input   [ 5 ]  :=
  p.points   acq.input   [ 6 ]  :=
  1 subfile  acq.input  array>file
  file.close                                                               541
  cr  ."        TMP data file created     :  "   filepass.asy      "type
     cr
;

\ ================================================================
\ !--------------------------------------------------------------!      546

  regular.datafile
  file.template
    8 comments
    integer dim[ 6 ] subfile                                           551
    integer dim[ s.length , s.chnls ] subfile
  end
: creat.datafile.dat
  datafile.dat   defer>  file.create
  datafile.dat   defer>  file.open                                         556
                                                    mycase            1
                                                       >comment
                                                    mydate            2
                                                       >comment
                                                    mytime            3
                                                       >comment
                                                    specifics         4
                                                       >comment
                                                    datafile.dat.p23  5    561
                                                       >comment
  1 subfile  acq.input  array>file
  2 subfile  db0 array>file
  file.close
  cr  ."     ASYST data file created     :  " datafile.dat "type  cr
  \ 1000 msec.delay                                                        566
  \ my.pause
;
```



```
: dat.file
  terminate.str  "upper   " Q"   "=  if exit then
  screen.clear                                                           571
  create.filepass.asy
  1  dat.file.flag    =
  if creat.datafile.dat
  then
; dat.file                                                               576
\ ================================================================

lower.inner.wnd {border}

nd                                                                       581
color.on
my.def.colors
forget forget.word.acq
.time
bell.1LL bell.2sl                                                        586
cdt
```

Pre-File.nam


```
22 35 23 78 window file.wnd                                                    1
: pre.file.name
  dir.lee.txt   " filepass.asy"   "cat    filepass.asy    ":=
  filepass.asy   defer>  file.open

  \  1 comment>   mycase             ":=                                       6
  \  2 comment>   mydate             ":=
  \  3 comment>   mytime             ":=
  \  4 comment>   specifics        ":=
  \  5 comment>   datafile.dat.p23     ":=
  5 comment>   tmp.s     ":=                                                   11
  file.close

  \  datafile.dat    datafile.dat  ":=

  file.wnd                                                                     16
  screen.clear
  my.def.colors
  ." Previous file name :  "
  \  int.on
  tmp.s  s.type.2                                                              21
  \  int.of
;
```

BELL.TXT


```
                                                                          1
: bell.1ll
  bell.flag 1 =
  if
    3  dup  ramp  300  over :=  swap    ramp  50 *               400 +
       tune
  then                                                                    6
;
: bell.3dn
  bell.flag 1 =
  if
    3  dup  ramp  300  over :=  swap    ramp  50 *               400 +    11
                                                    rev[ 1 ]
                                                       tune
  then
;

\  2  dup  ramp  300  over :=  swap    ramp  1200 *  rev[ 1 ]   400 -     16
   tune
: bell.2sl
  bell.flag 1 =
  if
    2  dup  ramp  100  over :=  swap    ramp  900  *  rev[ 1 ]    10 -
       tune
  then                                                                    21
;
: bell.1sl
  bell.flag 1 =
  if
    1  dup  ramp  100  over :=  swap    ramp  900  *  rev[ 1 ]    10 -    26
       tune
  then
;
```

Def-WinN.nam

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```
: Def-WinN.nam ; \ %----- Asyst Prog                                        1
\  sc  .date  ." /"  "time  s.type ."   Lee"   {29.line}
.date  ." /"  "time  s.type ."   Lee"
18 10 19 70  window lower.inner.wnd
1  2  13 78  window upper.wnd
\ 14 6  20 74  window lower.wnd                                            6
13 6  19 74  window lower.wnd
1  6  8  74  window {mes.wnd}
\ echo.off
```

Def-AcqN.nam


```
: Def-AcqN.nam ; \ %----- Asyst Prog                                        1
\ ------------------------------ Def-AcqN.nam
   -------------------------------
\ 02/20/94
\ ------------------------------------------------------------------------
token                       db0         exp.mem>   db0
token                       a.token     exp.mem>   a.token                  6
token                       token.0     exp.mem>   token.0

\ INTEGER
real    SCALAR T.RATE
        scalar s.dura                                                       11
integer SCALAR low.f.modulo
        SCALAR s.length
      \  SCALAR s.freq
        SCALAR s.chnls
        SCALAR #.times                                                      16
        SCALAR p.chnl
        SCALAR chan.beg.#
        SCALAR chan.end.#
        SCALAR p.points
      \ scalar s.dura                                                       21
        scalar pass.id
        scalar Mid.v
        scalar mid.flag
        scalar del.str.pos
        scalar del.time.1                                                   26
        scalar del.time.2
        scalar del.time.3
        scalar del.time.4
        scalar chan.now
                                                                            31
integer scalar dig.lim
real    scalar gain
        scalar v.to.h
        scalar gra.lower.lim
        scalar gra.upper.lim                                                36
        scalar vol.lower.lim
        scalar vol.upper.lim
        scalar dig.to.h
        scalar dig.to.v
\       scalar Mid.v                                                        41
        scalar dig.mid

dp.integer  scalar acq.del

40 string acq.del.s                                                         46
40 string datafile.da2
64 string reserved
64 string spe.str
1  string prn.str
1  string chk.file.str                                                      51
```



```
1  string dma.align.str
1  string dma.or.sync
3  string del.str.1
3  string del.str.2
3  string del.str.3                                                         56
3  string del.str.4
```

Def-AcqS.Spe

A01804-20161220-A007 ❖ December 20, 2016 ❖ [Page count: 3]

```
: Def-AcqS.spe ; \ %----- Asyst Prog                                    1
\ ------------------------ Def-AcqS.spe
   ------------------------------------
\ 02/20/94
\ ------------------------------------------------------------------

    1.      v.to.h            :=    \ linear factor                    6
   -5.      gra.lower.lim     :=
    5.      gra.upper.lim     :=
\    10.     v.to.h           :=    \ linear factor
\   -25.     gra.lower.lim    :=
\    25.     gra.upper.lim    :=                                        11
\    gra.lower.lim   v.to.h /  vol.lower.lim  :=    \ h =  v.to.h * v
\    gra.upper.lim   v.to.h /  vol.upper.lim  :=
\    4095    dig.lim          :=
\    10.     gain             :=    \ range of board <-> 4095
\    dig.mid  2. /  Mid.v     :=   \  2048  =>    0 V                  16
\    dig.mid  2. /  dig.mid   :=   \  2048  =>    0 V

\    gain  float  v.to.h *  dig.lim float /  dig.to.h  :=
\    gain  float            dig.lim float /  dig.to.v  :=
                                                                        21
: re.or.ir.tes
  1   2  =
\  datafile.dat.p2  1 "left      " r"  "=
\  datafile.dat.p2  1 "left      " R"  "=  or
  if                                                                    26
    40  s.freq            := \  #input s.freq :=
   200  dup    s.dura     := \  #input s.freq * s.length :=
         s.freq * s.length :=
     3   s.chnls           := \  #input s.chnls :=
     1   p.chnl            := \  #input p.chnl :=                       31
    320   s.freq            := \  #input s.freq :=
    15    dup    s.dura     := \  #input s.freq * s.length :=
          s.freq * s.length :=
     6    s.chnls           := \  #input s.chnls :=
     6    p.chnl            := \  #input p.chnl :=                       36
  else
\    300   s.freq             := \  #input s.freq :=
\    12    dup    s.dura      := \  #input s.freq * s.length :=
\    160   s.freq             := \  #input s.freq :=
\    32    dup    s.dura      := \  #input s.freq * s.length :=          41
\    200   s.freq             := \  #input s.freq :=
\    26    dup    s.dura      := \  #input s.freq * s.length :=
    200   s.freq             := \  #input s.freq :=
    26    dup    s.dura      := \  #input s.freq * s.length :=
          s.freq * s.length :=                                          46
    5     s.chnls           := \  #input s.chnls :=
    2     p.chnl            := \  #input p.chnl :=

    200   s.freq            := \  #input s.freq :=
    26    dup    s.dura     := \  #input s.freq * s.length :=           51
```



```
          s.freq * s.length :=
    2     s.chnls           := \  #input s.chnls :=
    1     p.chnl            := \  #input p.chnl :=
  then
;                                                                       56
\ re.or.ir.tes       \
   inv.of

\
   ------------------------------------------------------------------------


: acq.del.def                                                           61
  4   1000 *   acq.del   :=
  datafile.dat   3  "right    2 "left    acq.del.s   ":=

  " 12"  acq.del.s  "=
  if                                                                    66
          81   1000 *   acq.del  :=
  then
  " 13"  acq.del.s  "=
  if
         76  1000 *   acq.del  :=                                       71
  then
  " 16"  acq.del.s  "=
  if
         62  1000 *   acq.del  :=
  then                                                                  76
  " 19"  acq.del.s  "=
  if
         55  1000 *   acq.del  :=
  then
  " 20"  acq.del.s  "=                                                  81
  if
         53  1000 *   acq.del  :=
  then
  " 22"  acq.del.s  "=
  if                                                                    86
         51  1000 *   acq.del  :=
  then
  " 24"  acq.del.s  "=
  if
         49  1000 *   acq.del  :=                                       91
  then
;

: get.acq.spe
  \  dir.lee.txt  " lspe-1.dat"  "cat  defer> file.open                 96
  dir.lee.txt  " lSPE-ACQ.dat"  "cat  defer> file.open
  1  subfile  file>unnamed.array
  dup  [ 1 ]  s.freq     :=
  dup  [ 2 ]  s.dura     :=
  dup  [ 3 ]  chan.beg.#    :=                                          101
  dup  [ 4 ]  chan.end.#    :=
  dup  [ 5 ]  p.chnl        :=
```

```
    chan.end.#   chan.beg.# -   1 +    s.chnls :=

  dup   [ 6  ]   del.time.1     :=                                        106
  dup   [ 7  ]   del.time.2     :=
  dup   [ 8  ]   del.time.3     :=
  dup   [ 9  ]   del.time.4     :=
  dup   [ 10 ]   v.to.h         :=
  dup   [ 11 ]   gra.upper.lim  :=                                        111
  dup   [ 12 ]   gra.lower.lim  :=
  dup   [ 13 ]   del.str.pos    :=
  drop

  41   comment>   del.str.1   ":=                                         116
  42   comment>   del.str.2   ":=
  43   comment>   del.str.3   ":=
  44   comment>   del.str.4   ":=
  45   comment>   chk.file.str ":=
  \ chk.file.str   s.type my.pause                                        121
  46   comment>   dma.align.str ":=
  47   comment>   dma.or.sync   ":=
  file.close

    s.freq   s.dura *   s.length   :=                                     126
    gra.lower.lim    v.to.h /   vol.lower.lim   :=     \ h =   v.to.h * v
    gra.upper.lim    v.to.h /   vol.upper.lim   :=
    4095    dig.lim             :=
    10.     gain                :=    \ range of board <-> 4095
    dig.mid   2. /   Mid.v      :=   \   2048   =>    0 V                131
    dig.mid   2. /   dig.mid    :=   \   2048   =>    0 V

    gain   float   v.to.h *   dig.lim float /   dig.to.h   :=
    gain   float              dig.lim float /   dig.to.v   :=
                                                                          136
  50     acq.del    :=
;
get.acq.spe
```

Def-AnaN.nam

A01805-20161220-A008 ❖ December 20, 2016 ❖ [Page count: 5]

```
: Def-AnaN.nam ; \ %----- Asyst Prog                                          1
\ Asyst text file    ------------------ Def-AnaN.nam
   --------------------------
\
\
\ Note             : 1. name list for overall uses
\                      2. 03/25/91, 02/20/94                                  6
\ ---------------------------------------------------------------

echo.off

Integer             scalar array.size                                       11
                    scalar index
                    scalar i.count
                    scalar left.index
                    scalar right.index
                    scalar #.iter                                           16
                    scalar Mid.v.cutoff
                    scalar n.of.w
                    scalar zero.up.or.down
                    scalar aut.plo.fla
                    scalar t.fmt.width                                      21
                    scalar #.groups
                    scalar add.chnl
                    scalar shift.first.flag
\                   scalar lc.flag  \ line colors
                    scalar font.size.L                                      26
                    scalar font.size.N
                    scalar font.size.S
                    scalar int.flag
                    scalar 2in1.flag
                                                                            31
integer  scalar #.ysum
         scalar #.nsum
integer  scalar step.size  scalar tmp.v.ii
1        step.size :=
                                                                            36
integer  dim[ 3 ]  array  group.ele
real dim[ 3 ]  array  ysum
real dim[ 5 ]  array  nsum
real dim[ 3 ]  array  bcoe
                                                                            41
integer scalar drif.flag

integer           scalar chnl.no
                  scalar case.no
                  scalar item.no                                            46

integer scalar 1/10.index              INTEGER scalar r.ch1
        scalar 1/3.index                       scalar r.ch2
        scalar 1/2.index                       scalar fft.points
        scalar 1/10.w.p.i                      scalar i.smt                 51
```



```
        scalar 1/3.w.p.i                       scalar r.ch1.1
        scalar 1/2.w.p.i                       scalar r.ch1.2
        scalar b.fft.p                         scalar b.p.1
        scalar b.p.2                           scalar b.p.3
                                                                            56
real    scalar g.depth
        scalar gravity
        scalar tmp.period
        scalar w.l.o
        scalar w.l.n                                                        61
        scalar epslon

dp.real scalar 2pid
        scalar gttd
        scalar gtt/2pi                                                      66

real    scalar 1/10.w.h
        scalar 1/3.w.h
        scalar 1/2.w.h
        scalar ave.w.h                                                      71
        scalar rms.w.h
        scalar 1/10.w.p
        scalar 1/3.w.p
        scalar 1/2.w.p
        scalar ave.w.p                                                      76
        scalar rms.w.p
        scalar del.l
        scalar del.l.1
        scalar del.l.2
        scalar del.l.3                                                      81
        \ scalar gain
dp.real scalar 2pid/l
real    scalar cutoff.freq
        scalar x.pos
        \ scalar v.to.h                                                     86
        scalar depth.1
        scalar depth.2
        scalar depth.3

     40 string d&t                                                          91
      8 string file.ext
     30 string font.type.n

real scalar 1/3.w.p.sep.i
real scalar 1/3.w.h.sep.i                                                   96
real scalar 1/3.w.p.sep.r
real scalar 1/3.w.h.sep.r

\ ---------------------------------------------------------------
                                                                            101
integer  scalar #w
         scalar #r
         scalar #.case
         scalar #.chnl
         scalar #.item                                                      106
```

```
         scalar #.elem
         scalar coef.flag
         scalar cali.flag
         scalar smo.flag
         scalar shif.flag                                              111
         scalar kr.flag
         scalar smo.p
         scalar conv.flag
         scalar #.tmp.array
                                                                       116
real     scalar std.mea
         scalar std.dev
         scalar std.err
         scalar conf.int
         scalar conf.l.u                                               121
         scalar conf.l.l
         scalar deg.fre
         scalar coef.1.sp
         scalar coef.0.sp
         scalar f.beg   scalar f.end                                   126

30       string item.name
40       string tmp.s.2
 5       string case.flag
 5       string cnst.flag                                              131
 5       string whwp.flag
 1       string bat.flag

\ ================================================================
token    el.a               exp.mem> el.a                             136
token    5d.a               exp.mem> 5d.a
token    3d.a               exp.mem> 3d.a
token    r.ba               exp.mem> r.ba
token    token.1            exp.mem> token.1
token    token.2            exp.mem> token.2                          141
token    token.3            exp.mem> token.3
token    token.4            exp.mem> token.4
token    token.5            exp.mem> token.5
token    token.6            exp.mem> token.6
token    token.7            exp.mem> token.7                          146
token    token.8            exp.mem> token.8
token    token.9            exp.mem> token.9
token    token.10           exp.mem> token.10
token    token.11           exp.mem> token.11
token    token.12           exp.mem> token.12                         151
token    token.13           exp.mem> token.13
token    token.14           exp.mem> token.14
token    token.15           exp.mem> token.15
token    token.16           exp.mem> token.16
token    t1                 exp.mem> t1                               156
token    t2                 exp.mem> t2
token    t3                 exp.mem> t3
token    t4                 exp.mem> t4
token    t5                 exp.mem> t5
token    t6                 exp.mem> t6                               161
```



```
token    t7                 exp.mem> t7
token    t8                 exp.mem> t8
token    t9                 exp.mem> t9
token    t10                exp.mem> t10
                                                                       166
1        string nor.type
3        string ope.type
3        string h&v.flag

integer  scalar #.elem                                                 171
         scalar #.las.loop
         scalar #.inn.loop
         scalar #.out.loop
         scalar #.col
         scalar #.col.ini                                              176
         scalar t.fmt.width
         scalar case.no
         scalar chnl.no
         scalar item.no
         scalar elem.no                                                181
         scalar #.fft.pts
         scalar #.plt.pts
         scalar pt.beg  scalar pt.end
2 string xy.axis.str
1 string h.c.str                                                       186
1 string asc.str
1 string view.str
1 string non.stop.str
1 string forced.spe.str
1 string lc.str                                                        191
1 string grid.str

3 string now.gp
1 string cr.str
1 string cr.str.sep                                                    196
1 string scr.str
32  string y.label
32  string x.label
64  string misce.str
14  string  d&t.string                                                 201

integer  scalar col.1.pos  scalar col.2.pos
         scalar col.1.w    scalar col.2.w
         scalar #.#spe
         scalar lin.#                                                  206
         scalar f.no.c

17 1 +  #.#spe     :=
12      col.1.pos  :=
47      col.2.pos  :=                                                  211
13      col.1.w    :=
13      col.2.w    :=
real dim[ #.#spe ]             array  #spe
dim[ #.#spe , col.1.w ] string.array  #spe.str
dim[ #.#spe ,       3 ] string.array  "spe                             216
```

```
dim[ #.#spe , col.1.w ] string.array  "spe.str
Dim[ 7 , 12 ]           string.array  file.name.ary
```



Def-Ana1.1sp

A01806-20161220-A009 ❖ December 20, 2016 ❖ [Page count: 10]

```
: Def-Ana1.1sp ; \ %----- Asyst Prog                                    1
\ ------------------------------- Def-Ana1.1sp
   --------------------------
\
\
\ 02/22/94 by Y.R. Lee
\ ------------------------------------------------------------------    6

\ ==================================================================
\
\ Keywords       :  1. def-anas.spe 1 2 3
\                   2. for all specifications with minimized           11
   modification.
\
\ Note :
\
\ Written        :  Nov. 1993 by  Y-R Lee  ( 02/20/94)
\ ==================================================================    16

\ nd

fg.color   foreground
bg.color   background                                                  21

: def.values.ana
  \ --------------------------
  " gen"  cnst.flag           ":= \ for IND case flag
  " wha"  whwp.flag           ":= \ for wha or wpa                     26
  1       coef.flag            := \ 1(yes) unit conversion
  1       conv.flag            := \ 0 for calibration  else  for
     practical units
  9       cali.flag            := \ 1 for calibration
\ 0       asc.flag             := \ 1(yes) create ascii file with
   coef.flag
  xeq.flag   " r"  "=                                                  31
  xeq.flag   " w"  "=    or
  xeq.flag   " p"  "=    or
  if
    1     smo.flag             := \ 1(yes) smooth
    0     smo.flag             := \ 1(yes) smooth                       36
  else
    0     smo.flag             :=
\   1     smo.flag             :=
  then
  3       smo.p                :=                                      41
  0       Kr.flag              := \ 1(yes)
  9       shif.flag            := \ 0(No) 1(linear) , 2(parabolic) , 3(
     mean)
  1       mid.flag             := \ 0(0.) 1(2048.) 2(256.)
  0.      f.beg                :=
  200.    f.end                :=                                      46
          \ ------------------------------------
```



```
          mid.flag  0  =   if   0.      dig.mid :=   then
          mid.flag  1  =   if   2048.   dig.mid :=   then
          mid.flag  2  =   if   256.    dig.mid :=   then
  \ --------------------------                                          51
  3       #.tmp.array          := \ for # of columns in prn file
  \ 4     #.chnl               := \ for column added  ( > s.chnls )
  14      #.item               :=
  70      #.case               := \ for case file name strings
  2000    n.of.w               := \ max. number of waves per channel    56
  0.95    conf.int             := \ confidence interval
  10      em.color             := \ confidence interval
  \ --------------------------
  29.5    del.l.2              :=
  29.5    del.l.3              :=                                       61
  32.5    del.l.1              :=
  48.0    depth.2              :=  \  g.depth at point of reflection
     measurement
  48.0    depth.3              :=  \  g.depth at point of reflection
     measurement
  82.0    depth.1              :=  \  g.depth at point of reflection
     measurement
  0.005   epslon               :=  \  convergence criterion for Acc-    66
     Newton Method
  980     gravity              :=  \  unit : cm
  500     #.iter               :=
  2 10    ** fft.points        :=  \  -> 2048
  441     b.p.1                :=
  1       b.p.2                :=                                       71
  1       b.p.3                :=
  \ --------------------------
  0       mid.v.cutoff         :=
  30.0    g.depth              :=  \  g.depth at point of reflection
     measurement
  0       i.smt                :=  \  0 : no  ;  1 : yes                76
;
def.values.ana

dim[ #.case , 8 ] string.array  run.c.n
                                                                       81
\ dir.asy.sys  " spfn.sov"  "cat  defer> load.overlay

: smooth.spe
    case
    1   of  1.  smo.p  /   set.cutoff.freq                             86
        endof
    2   of  1.  smo.p  /   set.cutoff.freq
        endof
    3   of  1.  smo.p  /   set.cutoff.freq
        endof
    4   of  1.  smo.p  /   set.cutoff.freq
        endof
    5   of  1.  smo.p  /   set.cutoff.freq
        endof
    6   of  1.  smo.p  /   set.cutoff.freq                             91
        endof
```

```
    7   of  1.  smo.p  /   set.cutoff.freq
        endof
    8   of  1.  smo.p  /   set.cutoff.freq
        endof
    endcase
;                                                                    96

: item.title
    case
    1   of   "  1 ---- MEAN                          "   item.name ":=
        endof
    2   of   "  2 ---- STANDARD DEVIATION            "   item.name ":=
        endof
    3   of   "  3 ---- STANDARD ERROR                "   item.name ":=   101
        endof
    4   of   "  4 ---- UPPER CONFIDENCE LEVEL        "   item.name ":=
        endof
    5   of   "  5 ---- LOWER CONFIDENCE LEVEL        "   item.name ":=
        endof
    6   of   "  6 ---- SIZE                          "   item.name ":=
        endof
    7   of   "  7 ---- TOTAL                         "   item.name ":=
        endof
    8   of   "  8 ---- MAX                           "   item.name ":=   106
        endof
    9   of   "  9 ---- MIN                           "   item.name ":=
        endof
    10  of   " 10 --- RANGE OF CONFIDENCE           "   item.name ":=
        endof
    11  of   " 11 --- MEAN SQUARE                    "   item.name ":=
        endof
    12  of   " 12 --- SPECTRUM INTEGRAL              "   item.name ":=
        endof
    endcase                                                          111
;

: item.format
    case
    1   of  10 5      fix.format                                     116
        endof
    2   of  10 5      fix.format
        endof
    3   of  10 5      fix.format
        endof
    4   of  10 5      fix.format
        endof
    5   of  10 5      fix.format
        endof
    6   of  10 0      fix.format                                     121
        endof
    7   of             coef.flag  0  =
                       conv.flag  0  =   and
                       if
                          10 1 fix.format
                       else                                         126
```



```
                          10 3 fix.format
                       then
                          endof
    8   of             coef.flag  0  =
                       conv.flag  0  =   and
                       if                                           131
                          10 1 fix.format
                       else
                          10 4 fix.format
                       then
                          endof
    9   of             coef.flag  0  =                              136
                       conv.flag  0  =   and
                       if
                          10 1 fix.format
                       else
                          10 4 fix.format                           141
                       then
                          endof
    10  of  10 5       fix.format
        endof
    11  of             coef.flag  0  =
                       conv.flag  0  =   and
                       if                                           146
                          10 1 fix.format
                       else
                          10 5 fix.format
                       then
                          endof
    12  of             coef.flag  0  =                              151
                       conv.flag  0  =   and
                       if
                          10 1 fix.format
                       else
                          10 5 fix.format                           156
                       then
                          endof
    endcase
;

: wh.format                                                         161
  coef.flag  0  =
  conv.flag  0  =   and
  if
     7 1 fix.format
  else                                                              166
     7 2 fix.format
  then
;

\ ------------------------------------------------------------------  171
\ ==================================================================
: post.shift
  \ shift by mean
  \  dup
```

```
  dup       []size array.size :=      \   drop                          176
            []sum   array.size  /
            -
;
integer scalar  out>file.flag
: my.out>file.cont                                                      181
  out>file.flag 1 =
  if
    out>file.cont
  then
;                                                                       186

real scalar pre.datum
1    string pre.flag
\ : pos.or.neg
  " p" pre.flag ":=                                                     191
  " -" pre.flag ":=
: pre.xeq
  pre.flag " p" "= not
  pre.flag " n" "= not  and  if exit then
  pre.flag " p" "=                                                      196
  if
    \   sc cr cr " ----------- PPP" s.type pause
    2046 pre.datum        :=
    []size tmp.v.i  :=
    becomes> a.token                                                    201
    tmp.v.i 1 +    1
    do
      a.token [ i ]  pre.datum <=  if   pre.datum  a.token [ i ]  :=
          then
    loop
  then                                                                  206
  pre.flag " n" "=
  if
    2049 pre.datum        :=
    []size tmp.v.i  :=
    becomes> a.token                                                    211
    tmp.v.i 1 +    1
    do
      a.token [ i ]  pre.datum >=  if   pre.datum  a.token [ i ]  :=
          then
    loop
  then                                                                  216
  a.token
;

: shift.raw.data
  console                                                               221

  pre.xeq

  shif.flag  0  =   not
  if                                                                    226
\    console
    {29.line}
```



```
    70  29  goto.xy  b.t  " SHF-ing"  s.type
     2  0    fix.format   shif.flag  n.type   b.t
\    my.out>file.cont                                                   231
    \ out>file.cont
  then

  \ shif.flag  -->  0 : no operation
  \            -->  1 : linear                                          236
  \            -->  2 : palabolic
  \            -->  5 : mean
  \            -->  9 : dig.mid
  \  by drift
  \  dig.mid  dp>sp  -                                                  241
  1. *  becomes>  a.token  \ <-- added
  shif.flag
  case
     1  of  2 #.ysum  :=     3 #.nsum    :=  endof
     2  of  3 #.ysum  :=     5 #.nsum    :=  endof                     246
  endcase

  real
  shif.flag   dup  1 =   2 =  or
  if                                                                    251
    \ " SFT"  s.type
    0  ysum  :=
    0  nsum  :=
    a.token  []size  swap drop  array.size  :=
    #.nsum  1 +  1                                                      256
    do
      array.size  1 +  1
      do
        i  j  1 -  float  **    nsum [ j ] +                   nsum [ j ]
           :=
      loop                                                              261
    loop
    #.ysum 1 +   1
    do
      array.size  1 +  1
      do                                                                266
        i j 1 -  float  **   a.token  [ i ] *   ysum [ j ] +   ysum [ j
          ] :=
      loop
    loop

    shif.flag  2  =                                                     271
    if
      nsum [ 1 ]  nsum [ 3 ]  nsum [ 5 ]  * *
      nsum [ 2 ]  nsum [ 3 ]  nsum [ 4 ]  * *  2. *   +
      nsum [ 3 ]  nsum [ 3 ]  nsum [ 3 ]  * *  -
      nsum [ 1 ]  nsum [ 4 ]  nsum [ 4 ]  * *  -                        276
      nsum [ 2 ]  nsum [ 2 ]  nsum [ 5 ]  * *  -
      tmp.v  :=  \ delta
      ysum [ 1 ]  nsum [ 3 ] nsum [ 5 ] *  nsum [ 4 ] nsum [ 4 ] *  -  *
      ysum [ 2 ]  nsum [ 3 ] nsum [ 4 ] *  nsum [ 2 ] nsum [ 5 ] *  -  *
           +
```

```
      ysum [ 3 ]  nsum [ 2 ] nsum [ 4 ] *  nsum [ 3 ] nsum [ 3 ] *  -  *
           +
      tmp.v  /  bcoe [ 1 ]  :=
      ysum [ 1 ]  nsum [ 3 ] nsum [ 4 ] *  nsum [ 2 ] nsum [ 5 ] *  -  *
      ysum [ 2 ]  nsum [ 1 ] nsum [ 5 ] *  nsum [ 3 ] nsum [ 3 ] *  -  *
           +
      ysum [ 3 ]  nsum [ 2 ] nsum [ 3 ] *  nsum [ 1 ] nsum [ 4 ] *  -  *
           +
      tmp.v  /  bcoe [ 2 ]  :=
      ysum [ 1 ]  nsum [ 2 ] nsum [ 4 ] *  nsum [ 3 ] nsum [ 3 ] *  -  *
      ysum [ 2 ]  nsum [ 2 ] nsum [ 3 ] *  nsum [ 1 ] nsum [ 4 ] *  -  *
           +
      ysum [ 3 ]  nsum [ 1 ] nsum [ 3 ] *  nsum [ 2 ] nsum [ 2 ] *  -  *
           +
      tmp.v  /  bcoe [ 3 ]  :=
      array.size   ramp
      dup  dup *  bcoe [ 3 ] *
      swap  bcoe [ 2 ] *  +
      bcoe [ 1 ] +
    then

    shif.flag  1  =
    if
        nsum [ 3 ] ysum [ 1 ] *  nsum [ 2 ] ysum [ 2 ] *  -
        nsum [ 1 ] nsum [ 3 ] *  nsum [ 2 ] nsum [ 2 ] *  -
        /  bcoe [ 1 ]  :=
        nsum [ 1 ] ysum [ 2 ] *  nsum [ 2 ] ysum [ 1 ] *  -
        nsum [ 1 ] nsum [ 3 ] *  nsum [ 2 ] nsum [ 2 ] *  -
        /  bcoe [ 2 ]  :=
        bcoe [ 2 ]   array.size   ramp  *   bcoe [ 1 ] +
    then

    a.token  swap  -  a.token  :=
    a.token  ^sum  [ array.size ]  array.size /   mid.v   :=
  then

  shif.flag  5  =
  if
    a.token
    dup
                []size array.size :=
      mean      -        a.token  :=
\  \\980930    a.token
\  \\980930    dup      []size array.size :=
\  \\980930             []sum   array.size  /
\  \\980930             -       a.token  :=
    \       ^sum  [ array.size ]  array.size /   mid.v   :=
  then
  shif.flag  9  =
  if
    a.token  []size array.size  :=
    dig.mid  float  -   a.token :=
  then

  a.token  \  <-- added
```



```
  shif.flag  0  =  not
  if
    console
    70  29  goto.xy       ."           "
    previous.window
    " p"  xeq.flag  "=  not
    " r"  xeq.flag  "=  not  and
    " w"  xeq.flag  "=  not  and
    if
      " OK"  s.type
    then
\    my.out>file.cont
    \ out>file.cont
  then
    my.out>file.cont
;

: shift.raw.data.mean  \  by mean
  1.  *  \  <---- important
  dup  []size  tmp.v.i  :=
       []sum   tmp.v.i  /
  -
;

\   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

" k"  wnd.str ":=

\    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

: get.comment
  dup
  dup
  2  0 fix.format            ."              "     dup   .     ."   "
  10 3 fix.format     \       ."             "
  dup dup dup       comment> #spe.str  "[  ] ":=  #spe.str   "[  ]
     s.type
                                                  #spe  swap  [  ]
                                                     n.type \ cr
  ."           "
  dup dup      20 + comment> "spe.str  "[  ] ":=  "spe.str   "[  ]
     "type
  dup dup      40 + comment> "spe      "[  ] ":=  "spe       "[  ]
     s.type    cr
;
: get.par.file
  spe.str  ":=
  nd
  ." Exisiting Parameters "
  \  dir.lee.txt  " lspe-ana.dat"  "cat  spe.str  ":=
  spe.str   defer> file.open
  ."           (" spe.str  "type  ." )"  cr cr
```

```
  1 subfile      #spe        file>array
  cr

  0  tmp.v.i :=                                                    381
  begin
    tmp.v.i 1 +  tmp.v.i  :=
    tmp.v.i   get.comment
    tmp.v.i   #.#spe  =
  until                                                            386
  1  subfile   #spe  file>array
  file.close

  \  " y" my.pause.flag ":=
  \  my.pause                                                      391
  {29.line}
;
: recover.par.acq
  1  #spe swap [ ]  s.freq     :=
  2  #spe swap [ ]  s.dura     :=                                  396
     s.dura  s.freq *  s.length   :=
  3  #spe swap [ ]  chan.beg.#    :=
  4  #spe swap [ ]  chan.end.#    :=
     chan.end.#  chan.beg.# -  1 +   s.chnls :=
\ 3  #spe swap [ ]  s.chnls    :=                                  401
  5  #spe swap [ ]  p.chnl     :=
  6  #spe swap [ ]  del.time.1 :=
  7  #spe swap [ ]  del.time.2 :=
  8  #spe swap [ ]  del.time.3 :=
  9  #spe swap [ ]  del.time.4 :=                                  406
  10 #spe swap [ ]  v.to.h     :=
  11 #spe swap [ ]  gra.upper.lim :=
  12 #spe swap [ ]  gra.lower.lim :=
  13 #spe swap [ ]  del.str.pos   :=
\  13 #spe swap [ ]  group.ele [ 2 ]  :=                           411

  1  "spe     "[ ]  del.str.1    ":=
  2  "spe     "[ ]  del.str.2    ":=
  3  "spe     "[ ]  del.str.3    ":=
  4  "spe     "[ ]  del.str.4    ":=                               416
  5  "spe     "[ ]  chk.file.str ":=
  6  "spe     "[ ]  dma.align.str ":=
  7  "spe     "[ ]  dma.or.sync  ":=
;
\ dir.lee.txt  " lspe-acq.dat"  "cat                               421
\ get.par.file
\ recover.par.acq
: recover.par
  1  #spe swap [ ]  r.ch1.1    :=
  2  #spe swap [ ]  del.l.1    :=                                  426
  3  #spe swap [ ]  depth.1    :=
  4  #spe swap [ ]  b.p.1      :=
  5  #spe swap [ ]  r.ch1.2    :=
  6  #spe swap [ ]  del.l.2    :=
  7  #spe swap [ ]  depth.2    :=                                  431
  8  #spe swap [ ]  b.p.2      :=
```



```
\ 9  #spe swap [ ]  FFT.POINTS :=
  9  #spe swap [ ]  #.fft.pts  :=
  10 #spe swap [ ]  f.beg      :=
  11 #spe swap [ ]  f.end      :=                                  436
  12 #spe swap [ ]  #.groups   :=
  13 #spe swap [ ]  group.ele [ 1 ]  :=
  14 #spe swap [ ]  group.ele [ 2 ]  :=
  15 #spe swap [ ]  Add.chnl   :=
                                                                   441
\ 15 #spe swap [ ]  my.pause.flag    :=

  1  "spe     "[ ]  xy.axis.str  ":=
  2  "spe     "[ ]  wnd.str      ":=
  3  "spe     "[ ]  offset.str   ":=                               446
  4  "spe     "[ ]  y.lab.str    ":=
  5  "spe     "[ ]  h.c.str      ":=
  6  "spe     "[ ]  asc.str      ":=
  7  "spe     "[ ]  view.str     ":=
  8  "spe     "[ ]  prn.str      ":=                               451
  9  "spe     "[ ]  forced.spe.str  ":=
  10 "spe     "[ ]  my.pause.flag   ":=
  11 "spe     "[ ]  lc.str          ":=
  12 "spe     "[ ]  grid.str        ":=
                                                                   456
  lc.str "upper " Y" "=
  if    1
  else  0
  then  lc.flag :=
  grid.str "upper " Y" "=                                          461
  if    1
  else  0
  then  grid.flag :=

  h.c.str   pcx.h.c.str    ":=                                     466
;
\ get.par.file  \ can be placed in Def-AnaT.tsp
\ recover.par   \ can be placed in Def-AnaT.tsp
: my.out>file
  out>file                                                         471
  1  out>file.flag :=
;
: my.out>file.close
  out>file.close  0  out>file.flag :=
;                                                                  476
```

LSTA-0.TXT

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```
\
\ ================================================================
\ lsta-0
\ Keywords       :  1. Create ASCII data files w or w/o unit conversion
\                   2. Data statistics
\                   3. Autocorrelation
\                   4. Power spectrum
\                   5. Wavelet transform
\                   6. File to array  &  Array to file
\
\ Written        :  Nov. 1993 by  Y-R Lee
\ ================================================================
1 29.flag :=
echo.off
{29.line}
\ echo.on
axis.defaults
: menu.word
  menu.flag 0 =
  if
    forget.all
  then
; menu.word
: lsta-0 ;

token     rds.a               exp.mem> rds.a
token     freq.a              exp.mem> freq.a
token     rds.a.app           exp.mem> rds.a.app
token     p.s.a.div           exp.mem> p.s.a.div
token     v.4&5               exp.mem> v.4&5
\ ================================================================
integer scalar v.4&5.size
        scalar #.sec
        scalar lin.#
        scalar f.no.c

3       string h&v.flag

dp.real    scalar v.min

integer scalar i.1
        scalar i.2
        scalar i.3
        scalar v.4&5.size
        scalar plot.flag
        scalar p.s.d.flag
        scalar shif.flag.2
\       scalar menu.flag
real    scalar v.4
        scalar v.5

integer scalar elem.no
```



```
        scalar #.chnl.p
        scalar #.item.p
        scalar console.flag
        scalar a.c.c.p.flag
        scalar p.s.plt.flag
        scalar wt.flag
\  1             console.flag  :=  \ 1: no output for item 1--12 , only
   p.s.d
0               console.flag  :=  \ 1: no output for item 1--12
: menu.word
  menu.flag 0 =
  if
    dir.lee.txt   " def-winn.nam"  "cat   defer> load
    dir.lee.txt   " def-acqn.nam"  "cat   defer> load
    dir.lee.txt   " def-anan.nam"  "cat   defer> load
  then

; menu.word
dir.lee.txt   " dwt.txt"  "cat  defer>  load
\ %%

\ 0  menu.flag  :=
: initial.parameter
  20              n.pwtset   :=
  1               #.item.p   :=
  2               #.chnl.p   :=   \ for 5D array
  3  0  fix.format
  cr
  " P.S.D:" s.type
\  0  get.val  p.s.d.flag   :=
  1    p.s.d.flag   :=
  0    p.s.d.flag   :=
  " shift:" s.type
\  0  get.val  shif.flag  :=
\ \  0    shif.flag  :=
  " Plot:" s.type
\  0  get.val  plot.flag  :=
  0    plot.flag  :=
  ." nor.type(X/N):"
\   " X"    get.str  nor.type  ":=
  " X"      nor.type  ":=
  ." ope.type(___/rat/dif):"
\   " ___"  get.str  ope.type  ":=
  " ___"    ope.type  ":=

    " ver"   h&v.flag  ":=
  \ " hor"   h&v.flag  ":=

    " d"     xeq.flag  ":=
  \ " N"     nor.type  ":=
  \ " X"     nor.type  ":=
  \ " ___"   ope.type  ":=   \ No operation for base
  \ " rat"   ope.type  ":=   \ ratio to base
  \ " dif"   ope.type  ":=   \ difference to base
     0       smo.flag   :=
```

```
  nor.type   " x"     "=  if      " X"      nor.type   ":=   then
  nor.type   " n"     "=  if      " N"      nor.type   ":=   then

  nor.type   " N"     "=                                                  111
  ope.type   " ___"   "=  and   if   " .sN"   file.ext   ":=  then
  nor.type   " N"     "=
  ope.type   " rat"   "=  and   if   " .sNR"  file.ext   ":=  then
  nor.type   " N"     "=
  ope.type   " dif"   "=  and   if   " .sND"  file.ext   ":=  then          116
  nor.type   " X"     "=
  ope.type   " ___"   "=  and   if   " .sX"   file.ext   ":=  then
  nor.type   " X"     "=
  ope.type   " rat"   "=  and   if   " .sXR"  file.ext   ":=  then
  nor.type   " X"     "=                                                  121
  ope.type   " dif"   "=  and   if   " .sXD"  file.ext   ":=  then

    0               a.c.c.p.flag  :=
    0               p.s.plt.flag  :=
\    1               p.s.plt.flag  :=                                     126
    0               wt.flag       :=
  1  plot.flag  =
  if
    0               a.c.c.p.flag  :=
    1               p.s.plt.flag  :=                                     131
    1               wt.flag       :=
  then
;
initial.parameter
                                                                         136
\ : 1st.token        token.2  sub[ 1025 , 1024 ]  ;    \ r03 -> 2&3
\ : 2nd.token        token.3  sub[ 1025 , 1024 ]  ;    \ r03 -> 2&3
  : 1st.token        token.1                      ;    \ r03 -> 2&3
  : 2nd.token        token.2                      ;    \ r03 -> 2&3
: p.s.xy.flag      xoyo  xnyn ;                                          141
: wt.xy.flag       xlyl  xnyn ;

\ ------------------------------------------------------------------
: menu.word.2
  menu.flag 0 =                                                          146
  if
\    dir.lee.txt  " def-acqs.spe"  "cat   defer> load
\    dir.lee.txt  " def-ana1.1sp"  "cat   defer> load
  then
\    def.values.ana                                                      151
    dir.lee.txt  " def-acqs.spe"  "cat   defer> load
    dir.lee.txt  " def-ana1.1sp"  "cat   defer> load
  dir.lee.txt  " def-anat.tsp"  "cat   defer> load
  dir.lee.txt  " lcri.cri"      "cat   defer> load
; menu.word.2                                                            156
\ 0  smo.flag  :=

: reset.dig.mid
\ ------------------------------------
  mid.flag  0  =   if   0      dig.mid :=   then                         161
```



```
  mid.flag  1  =   if   2048   dig.mid :=   then
  mid.flag  2  =   if   256    dig.mid :=   then
\ ------------------------------------
;
\ reset.dig.mid                                                          166

: find.s.chnls
\  bat.flag  "upper " Y" "= not
\  if
    input.case.flag                                                      171
\  then
;
find.s.chnls

dir.lee.txt  " Coef-" "cat  " gp"      "cat  " .dat" "cat   defer> load   176
\  put   " eee"  " r03"  " h01"  " ldv"
dir.lee.txt  " Coef-" "cat  " gp"      "cat  " .txt" "cat   defer> load
\  check exist
dir.lee.txt  " Coef-" "cat  cnst.flag  "cat  " .dat" "cat   defer> load
dir.lee.txt  " get-s-ch.txt"                         "cat   defer> load   181

{29.line}

: change.parameter
  case.flag  " ind"  "=  not                                             186
  if
  nor.type   " N"    "=
  ope.type   " ___"  "=  and   if   " -N.sta"   file.ext  ":=  then
  nor.type   " N"    "=
  ope.type   " rat"  "=  and   if   " -NR.sta"  file.ext  ":=  then      191
  nor.type   " N"    "=
  ope.type   " dif"  "=  and   if   " -ND.sta"  file.ext  ":=  then
  nor.type   " X"    "=
  ope.type   " ___"  "=  and   if   " -X.sta"   file.ext  ":=  then
  nor.type   " X"    "=                                                  196
  ope.type   " rat"  "=  and   if   " -XR.sta"  file.ext  ":=  then
  nor.type   " X"    "=
  ope.type   " dif"  "=  and   if   " -XD.sta"  file.ext  ":=  then
  then
;                                                                        201
change.parameter

\ for p.sub & plt
  1                 i.1          :=  \ lin.#
  1024              i.2          :=  \ fft.pts                           206
  7                 i.3          :=  \ #.sec
  .01               v.4          :=  \ Hz_init
  20.               v.5          :=  \ Hz_end
  0.1               v.4          :=  \ Hz_init
  10.               v.5          :=  \ Hz_end                            211

\ ------------------------------------------------------------
 21                 v.4&5.size   :=
 real  dim[  v.4&5.size  ] unnamed.array
 dup   becomes> p.s.a.div                                                216
```

```
       becomes> v.4&5

\ v.4&5 @[ 1 ]  enter[
\  0.01 , 0.10 , 0.50 , 1.00 , 1.50  ,
\  1.75 , 2.00 , 2.25 , 2.50 , 2.75  ,                                  221
\  3.00 , 3.25 , 3.50 , 3.75 , 4.00  ,
\  4.50 , 5.00 , 6.00 , 8.00 , 10.00 ,
\ 20.00
\ ]
 v.4&5 @[ 1 ]  enter[                                                   226
  1.4  , 1.5  , 1.6  , 1.7  , 1.8   ,
  1.9  , 2.0  , 2.1  , 2.2  , 2.3   ,
  2.4  , 2.5  , 2.6  , 2.7  , 2.8   ,
  2.9  , 3.0  , 3.1  , 3.2  , 3.3   ,
  3.4                                                                   231
 ]
 v.4&5
 []size              v.4&5.size  :=
 v.4&5.size 1 -      #.elem      :=
 sub[ 1 , #.elem ]   becomes> el.a                                      236

 \ real  dim[ 1 , #.case , 2 , 1 , el.a.size ] unnamed.array
 \ real  dim[ 1 , #.case , #.chnl.p , #.item.p  , #.elem ] unnamed.array
   real  dim[ 1 , #.case , #.chnl.p , #.item.p  , #.elem ] unnamed.array
 dup  becomes> 5d.a          \ P.S. for channel 2 & 3                   241
      becomes> r.ba          \ for base

\ ---------------------------------------------------------------------
\ p.s.plt
\ ---------------------------------------------------------------------  246
: get.log.min
  11.  v.min :=
  begin
  dup
  v.min   1 -  v.min  :=                                                251
  10.  v.min  **    swap /     1.   <
  until
  10. v.min  **    v.min    :=
  drop
;                                                                       256

: p.s.div \ [ array , #.fft.pts , #.sec , wnd.str , div_array --  ]
  ."   "  " P.S.D"  s.type
  dup  1. *  becomes>  p.s.a.div
       1. *  becomes>  el.a                                             261
  wnd.str     ":=
  #.sec       :=
  #.fft.pts   :=
                                      \ #.plt.pts  ~  tmp.v.i.4
  #.fft.pts   #.sec   wnd.str     my.p.s.bat                            266
      v.4&5   [ 1 ]   s.freq /   #.fft.pts *   tmp.v.i.4  :=
      v.4&5.size  0 +  1
      do
          v.4&5   [ i 1 + ]   s.freq /   #.fft.pts *   #.plt.pts  :=
          dup                                                           271
```



```
          sub[  tmp.v.i.4  ,  #.plt.pts  tmp.v.i.4 - ]
          []sum  2.  *
          p.s.a.div  [ i ]  :=
          #.plt.pts   tmp.v.i.4  :=
      loop                                                              276
      drop
      0.    p.s.a.div [ v.4&5.size ]   :=
  "  OK"  s.type
;                                                                       281

\ ---------------------------------------------------------------------
: p.s.sub
\ cr
\ " [ array , lin#, #.fft.pts , #.sec , s.wnd , Hz_b , Hz_e --  x_a ,
   y_a  ]"
\ s.type                                                                286
      tmp.v          :=   \  plt_hz_end   <  0.5 * s.freq
      tmp.v.4        :=   \  plt_hz_init  >  0.0
      wnd.str       ":=
      #.sec          :=
      #.fft.pts      :=                                                 291
      lin.#          :=
  tmp.v    #.fft.pts *   s.freq /     #.plt.pts   := \ plt_Hz --> #
     .plt.pts
  #.fft.pts   #.sec   wnd.str     my.p.s.bat
  sub[ 1 , #.plt.pts ]                \ y-array
                                                                        296
  #.plt.pts  real  ramp               \ x-array
  s.freq *   #.fft.pts /
  swap                                \ -->  x , y
      tmp.v.4  #.fft.pts *  s.freq /   tmp.v.i.4  :=
      swap  sub[  tmp.v.i.4 ,  #.plt.pts  tmp.v.i.4 - ]   \ --> y , x   301
      swap  sub[  tmp.v.i.4 ,  #.plt.pts  tmp.v.i.4 - ]   \ --> x , y
;

\ ---------------------------------------------------------------------
\ ---------------------------------------------------------------------  306
: p.s.plt  \ [ array , line.# , #.fft.pts , #.sec , s.wnd , Hz_b , Hz_e
   -- ]

  nd
  cr
  "  [ array , line.# , #.fft.pts , #.sec , s.wnd , Hz_b , Hz_e -- ]"   311
  s.type
  p.s.sub
  dup  []min/max       tmp.v   :=     \ v_world_set
\ dup  []min/max   drop     0.02    tmp.v   :=     \ v_world_set for r03
   -w111
  get.log.min                                                           316
  xy.data.fit

  gd
  p.s.xy.flag
  10  10  axis.divisions                                                321
  vertical
```

```
     " o"  y.axis.flag  "=   \ y_log
     if
         \ grid.off
         0          1  label.points                                    326
         -1.2  0.0  9  label.format
         -0.8  0.6  9  label.format
         -1.0  0.6  6  label.format
         10    6       axis.divisions
         0.0000001    0.10                                world.set     331
         \  v.min        tmp.v                                world.set
         \  ! Don't remove the above two lines
         axis.on
     else
         0          2  label.points                                    336
         -1.2  0.0  5  label.format
     \   0.           0.050                               world.set
     \ \    0.           0.015                                world.set
         0.           tmp.v                               world.set
         axis.on                                                       341
     then
  horizontal
     " o"  x.axis.flag  "=   \ y_log
     if
         \  grid.off                                                   346
         10  10  axis.divisions
         0          1  label.points
         -0.5 -1.2  5  label.format
         8     12      axis.divisions
         tmp.v.4    #.plt.pts  float  s.freq *  #.fft.pts /           351
            world.set
         axis.on
     else
         8   10  axis.divisions
         0          2  label.points
         -0.5 -1.2  5  label.format                                    356
\        0.         #.plt.pts  float  s.freq *  #.fft.pts /
    world.set
\        tmp.v.4    #.plt.pts  float  s.freq *  #.fft.pts /
    world.set
         v.4        v.5
            world.set
         axis.on
     then                                                             361

\ -----------------------------------------------------------------
  hp
    xy.axis.plot
    lin.# xydp                                                        366
\     "  Frequency (Hz)"  " Power spectral (cm**2 sec)"  0.02
    labxy.stack
       "  Frequency (Hz)"  " Power density  (cm**2 sec)"  0.02
          labxy.stack
      normal.coords
      0.75  0.85    position
      datafile.dat.p23  "len  4 -  "left  datafile.dat.p2 ":=          371
```



```
      " Case: "  datafile.dat.p2   "cat               label
      0.    0.      position
      world.coords  \  ---> important
;                                                                     376
\ -----------------------------------------------------------------
: p.s.plt.lap  \ [ array , line.# , #.fft.pts , #.sec , s.wnd , Hz_b ,
   Hz_e -- ]
  p.s.sub
  world.coords
      lin.# xydp                                                      381
;
\ -----------------------------------------------------------------

\ real dim[ 2 , #.case , #.chnl , #.item ] unnamed.array  1. * becomes>
   rds.a
real dim[ 1 , #.case , #.chnl , #.item ] unnamed.array  1. * becomes>  386
   rds.a

: chnl.added   \  col.3 - col.4
  tmp.v.i.4  :=
  tmp.v.i.3  :=
        tmp.v.i.3  channel.const                                      391
        db0  xsect[ ! , tmp.v.i.3 ]
        chnl.no  smooth.spe   \ add 04-20-97
        shift.raw.data  \  by drift
        conv.formula
        smooth.xeq                                                    396
\        shift.raw.data  \  by drift
        tmp.v.i.4  channel.const
        db0  xsect[ ! , tmp.v.i.4 ]
        chnl.no  smooth.spe   \ add 04-20-97
        shift.raw.data  \  by drift                                   401
        conv.formula
        smooth.xeq
\        shift.raw.data  \  by drift
        -
;                                                                     406

: pre.unit.conv   \  [   -  sub.array ]
    chnl.no   s.chnls  <=
    if
        chnl.no  channel.const                                        411
        get.forced.spe.sta
        \ db0  xsect[ ! , chnl.no ]
        chnl.no  get.chan.data
        chnl.no  smooth.spe   \ add 04-20-97
        shift.raw.data  \  by drift                                   416
        conv.formula

        smooth.xeq
        cr ." ---------sss" smo.flag n.type
\        shift.raw.data  \  by drift                                  421
        dup  chnl.no  copy.to.token
```

```
    else
        3  2  chnl.added  \ 3 - 2
    then                                                          426
;

: show.flag
  1 0 fix.format  ."  ("
  ."  f"  smo.flag  0 n>s  s.type  ."  p"  smo.p      0 n>s  s.type      431
  ."  e"  coef.flag 0 n>s  s.type  ."  s"  shif.flag  0 n>s  s.type
  ."  w"  wnd.str          s.type   ."  )"
;
: c.d.a      \ create ASCII file  w/o filter
  cr mycase       "type                                               436
  show.flag
  cr mydate       "type    5 0 fix.format
  cr mytime       "type    48  mytime  "len  -  spaces            "drop
  ." Sampling frequency    :"   s.freq              .    ."   Hz"
  cr specifics    "type    48  specifics  "len  - spaces           "drop  441
  ." Sampling time length  :"   s.length s.freq /   .    ."  Sec"

    s.length 1 +  1
    DO cr
      i  get.token.smooth.element                                 446
      s.chnls 1 +   1
      do
       \ i   item.format
       \ 10  4   fix.format
        11  4   sci.format                                        451
        tmp.array [ i ]
        .    ."      "
      loop
    loop
  cr                                                              456
;

: make.ascii
\ asc.str  " y"  "=
\ if                                                              461
    b.t ."      ----->  ASCII : " b.t  datafile.asc s.type  cr
    datafile.asc   defer>  delete
    datafile.asc   defer>  out>file
    console.off
    c.d.a                                                         466
    out>file.close
\ else
\   console.off  echo.off
\ then
;                                                                 471

\ : create.1d.data.file
\   1st.token datafile.dat.p23  "len  3   -  "left  " 1" "cat
   atof.bat
\   2nd.token datafile.dat.p23  "len  3   -  "left  " 2" "cat
   atof.bat
\ ;                                                               476
```



```
\ dir.asy.sys  " spfn.sov"  "cat  defer> load.overlay
: rain.sta
  deg.fre  300  >
  if  300  deg.fre  :=                                            481
  then

  \ with.frequencies
  without.frequencies
  cr                                                              486
  #.chnl  1 +   1
  do
    i  chnl.no  :=                    \ channel No.
    chnl.no  .                          \ channel No.
    pre.unit.conv                                                 491

    p.s.d.flag  0  <>
    if
      dup   1   i.2   i.3   wnd.str   v.4   v.5     p.s.sub
      swap  drop              \ drop x_array of p.s               496
      []sum
      2.  *                   \ <-----  due to symmetry
      \  i.2  float  /    \ already in density <-- don't divide by #
         .fft.pts
    else
      0.                                                          501
    then
    rds.a [ #w , #r , chnl.no , 12 ]  :=  \ spectrum integral

    p.s.d.flag  0  <>
    chnl.no     1  <>  and                                        506
    if
      dup   i.2   i.3   wnd.str    v.4&5     p.s.div
      v.4&5.size    1
      do
        p.s.a.div  [ i ]                                          511
        5d.a  [ #w , #r , chnl.no 1 - , 1 , i ]  :=
        \ spectrum integral
      loop
    then
                                                                  516
    dup                                 []size  tmp.v.i   :=
    mean                        dup             std.mea   :=
                          rds.a [ #w , #r , chnl.no , 1  ]  :=  \ mean
    \   dup   std.mea  -   dup  *   []sum       tmp.v.i  /
    dup                  dup  *   []sum       tmp.v.i  /         521
                          rds.a [ #w , #r , chnl.no , 11 ]  :=  \ rms ** 2
    dup
    \ ----- no more than 11000 elements due to Memory
    sub[ 1 , 10500 ]
    \ ------------------------------------------------            526
    sample.variance     sqrt    dup           std.dev   :=
                          rds.a [ #w , #r , chnl.no , 2  ]  :=  \ std.  dev.
    std.dev  tmp.v.i  sqrt / dup              std.err   :=
                          rds.a [ #w , #r , chnl.no , 3  ]  :=  \ std.
```

```
                        error
    1.    1. conf.int - 2. /  -   \ confidence interval fractile
          deg.fre    student-t.fractile
          std.err *  dup  2 *
                       rds.a [ #w , #r , chnl.no , 10 ]  :=  \ conf. int.
                            range
                     dup      std.mea       +    conf.l.u   :=
                              std.mea  swap -    conf.l.l   :=
    conf.l.u           rds.a [ #w , #r , chnl.no , 4  ]  :=  \
    conf.l.l           rds.a [ #w , #r , chnl.no , 5  ]  :=  \
    tmp.v.i            rds.a [ #w , #r , chnl.no , 6  ]  :=  \ []size
    std.mea tmp.v.i *  rds.a [ #w , #r , chnl.no , 7  ]  :=  \ total
    []min/max          rds.a [ #w , #r , chnl.no , 8  ]  :=  \ max
                       rds.a [ #w , #r , chnl.no , 9  ]  :=  \ min
  loop

  #r  1 +  #r :=
  \  release.overlay
  asc.str  " y"  "=
  if
    make.ascii
  else
    console.off
  then
  \ \  create.1d.data.file
;
\ release.overlay
\ ================================================================
integer scalar dma.s.chnls
: d.d.o.c
  "dup   run.c.n   "[ #r ]  ":=
  \ d.d.o
  "dup
  dir.lee.asc  "swap "cat  " .asc" "cat  datafile.asc  ":=
  dir.lee.dat  "swap "cat  " .dat" "cat  defer> file.open
  1 comment>   mycase           ":=
  2 comment>   mydate           ":=
  3 comment>   mytime           ":=
  4 comment>   specifics        ":=
  5 comment>   datafile.dat.p23 ":=
  1 subfile    acq.input  file>array
               acq.input  [ 1 ]    t.rate   :=
               acq.input  [ 2 ]    s.length :=
               acq.input  [ 3 ]    s.freq   :=
               acq.input  [ 4 ]    s.chnls  :=
               acq.input  [ 5 ]    #.times  :=
  cr  ." ----------------"   #.times n.type

  acq.input  [ 1 ]    0  >
  if
    0                 #.times :=
  then
  #.times  0  =
  if
    2 subfile    file>unnamed.array  becomes> db0
```



```
  else
  then
  file.close
  real  s.length  ramp   becomes>  token.1
  0.  token.1  :=
  token.1   becomes>  token.2
  token.1   becomes>  token.3
  token.1   becomes>  token.4
  token.1   becomes>  token.5
  token.1   becomes>  token.6
  token.1   becomes>  token.7
  token.1   becomes>  token.8
  token.1   becomes>  token.9
  token.1   becomes>  token.10
  token.1   becomes>  token.11
  token.1   becomes>  token.12
  token.1   becomes>  token.13
  token.1   becomes>  token.14
  token.1   becomes>  token.15
  token.1   becomes>  token.16
  s.length     deg.fre          :=
  integer  dim[ s.length        ] unnamed.array  1. *  becomes> freq.a
  1. freq.a :=
  cr  show.flag    3 2 fix.format ."  conf:"  conf.int   .
  ."    "  " <----: " datafile.dat.p23  s.type
  5 0 fix.format
;

\ ================================================================
integer scalar #.c.app
2  #.c.app  :=
real dim[ 2 , #.case , #.c.app , #.item ] unnamed.array  1. * becomes>
   rds.a.app

: create.rds.a.app
  #.item 1 + 1   \  for appendix channel No.1
  do
    i  item.no  :=
    #r   1
    do
      i  case.no  :=
      \     #.c.app 1 +   1
      1       1 +   1
      do
        i  chnl.no  :=
        rds.a     [ #w , case.no ,    3    , item.no ]
        rds.a     [ #w , case.no ,    2    , item.no ]  /
        rds.a.app [ #w , case.no , chnl.no , item.no ]  :=
      loop
    loop
  loop

  #.item 1 + 1   \  for appendix channel No.2
  do
    i  item.no  :=
```

```
    #r    1
    do
      i   case.no   :=
\   1.   rds.a.app [ #w , case.no ,     2     , item.no ]    :=   \ initial
      2        1 +    2
      do
        i   chnl.no   :=
        rds.a.app [ #w , case.no ,     1     , item.no ]
        rds.a.app [ #w ,    1     ,     1     , item.no ]   /
        rds.a.app [ #w , case.no , chnl.no , item.no ]   :=
      loop
    loop
  loop
;
\ ================================================================
\ dir.lee.txt   " 1.1"   "cat   defer> load
\ ================================================================
: create.5d.a.X&N
  nor.type   " N"   "=
  if
    #.chnl.p   1 +   1
    do
    i   chnl.no   :=
      #.case   1 +    1
      do
        i      case.no   :=
        0.       tmp.v   :=
        #.item.p 1 +   1
        do
          i   item.no   :=
          #.elem 1 +    1
          do
            i elem.no   :=
            5d.a    [ #w , case.no , chnl.no , item.no , elem.no ]
            tmp.v   +       tmp.v   :=
          loop \ elem
          #.elem 1 +    1
          do
            i   elem.no :=
            5d.a    [ #w , case.no , chnl.no , item.no , elem.no ]
            tmp.v   /
            5d.a    [ #w , case.no , chnl.no , item.no , elem.no ]   :=
          loop   \ elem
        loop   \ item.p
      loop   \ case
    loop   \ chnl
  then
;

\
   ------------------------------------------------------------------------

: operation.binary
  ope.type   " rat"   "=   if       /     then
  ope.type   " dif"   "=   if       -     then
```



```
;
: ratio.or.difference.to.base
  ope.type   " rat"   "=
  ope.type   " dif"   "=    or
  if
    #.item.p     1 +    1    \ set base
    do
      i   item.no    :=
      #.chnl.p   1 +   1
      do
        i   chnl.no   :=
        #.case 1 +   1
        do
          i      case.no   :=
          #.elem 1 +     1
          do
              i   elem.no :=
              5d.a   [ #w , case.no , chnl.no , item.no , elem.no ]
              r.ba   [ #w , case.no , chnl.no , item.no , elem.no ]   :=
              \   cr     elem.no   .   chnl.no .    case.no .    item.no   .
              \     r.ba   [ #w , case.no , chnl.no , item.no , elem.no ]
                  .
          loop \ v.4&5
        loop \ case 1
      loop \ tmp.v.i
    loop   \ elem.app

    #.item.p     1 +    1
    do
      i   item.no    :=
      #.chnl.p   1 +   1
      do
        i   chnl.no   :=
        #r    1
        do
          i      case.no   :=
          #.elem 1 +     1
          do
            i   elem.no :=
            5d.a   [ #w , case.no , chnl.no , item.no , elem.no ]
            r.ba   [ #w ,     1     , chnl.no , item.no , elem.no ]        \
                 case 1
            operation.binary
            5d.a   [ #w , case.no , chnl.no , item.no , elem.no ] :=
          loop \ v.4&5
        loop \ case
      loop \ tmp.v.i
    loop   \ elem.app
  then
;
\ ================================================================
10              t.fmt.width   :=
: el.a.fmt
  " hor"   h&v.flag   "=
  if
```

```
    t.fmt.width          2           fix.format
    else
    t.fmt.width  0 -     2           fix.format                    746
  then
;
: data.format
  " N"  nor.type  "=
  if                                                               751
    t.fmt.width          4           fix.format
  else
    t.fmt.width  0 -     5           fix.format
  then
;                                                                  756
: get.item.title
  12          item.title
  item.name   s.type
  show.flag
                      ."   Wnd:"  wnd.str  s.type                  761
  4 0 fix.format      ."   fft:"   i.2  n.type
  1 0 fix.format      ."   sec:("  i.3  n.type  ." *2+1)"
  5 2 fix.format      ."   Freq:"  v.4  n.type  ." --"   v.5  n.type
  cr
  ."    Chan."                                                     766
  1 0 fix.format
  i   1 +   .   \ for r03
  \ i   .
  ." ("  nor.type  s.type  ." )"
;                                                                  771
: arrange.3d.a.asc.p  \  <-- el.a , run.c.n ,  3d.a
  becomes>  a.token
  #.las.loop 1 +  1
  do
      get.item.title                                               776
      \  print column titles
      " hor"  h&v.flag  "=  if   ."   "         then
      " ver"  h&v.flag  "=  if   ."     "       then
      #.inn.loop 1 +      #.col.ini  #.col +    <
      if                                                           781
        #.inn.loop 1 +
      else
        #.col.ini      #.col     +
      then
             #.col.ini                                             786
      do
        " hor"  h&v.flag  "=
        if
          el.a.fmt
          el.a [   i     ] . \  ."   "                           791
        else
          run.c.n   "[    i    ]   "type   ."   "
        then
      loop
      cr                                                           796

      \  print raw title and data
```



```
      #.out.loop  1 +   1
      do
        " hor"  h&v.flag  "=                                       801
        if
          ."     "
          run.c.n   "[    i    ]   "type   ."   "
        else
          ."   "  \ 2 spaces     __t.fmt.width__                   806
          el.a.fmt
          el.a [    i    ] .
          ."   "
        then
                                                                   811
        #.inn.loop 1 +       #.col.ini   #.col  +     <
        if
          #.inn.loop  1 +
        else
          #.col.ini  #.col +                                       816
        then
                   #.col.ini
        do
          data.format
          a.token      [  k  ,  j  ,  i  ]   .                     821
        loop
        cr
      loop
      cr
  loop                                                             826
;
: arrange.3d.a.asc           \ for case 1st , channel 2nd  [ array -- ]
  100  #.col            :=   \ increment , place at the same row
  10   #.col            :=   \  Cases arranged in the same row
  1    #.col.ini       :=                                          831
  begin
    dup
    arrange.3d.a.asc.p
    #.col       #.col.ini     +   #.col.ini       :=
    #.inn.loop  #.col.ini       <=                                 836
  until
  drop
;
token  t9    exp.mem> t9
: create.3d.a.asc                                                  841
  #.chnl.p   #.las.loop :=    \ 3rd
\ #r 1 -     #.out.loop :=    \ 2nd
\ #.elem     #.inn.loop :=    \ 1st

  " hor"  h&v.flag  "=                                             846
  if
    #r 1 -      #.out.loop :=
    #.elem      #.inn.loop :=
  else
    #r 1 -      #.inn.loop :=                                      851
    #.elem      #.out.loop :=
  then
```

```
real dim[  #.las.loop , #.out.loop , #.inn.loop  ]  unnamed.array
becomes> 3d.a

    create.5d.a.X&N
    ratio.or.difference.to.base

p.s.d.flag  0   <>
if
  #.item.p    1 +   1        \ 4th D
  do
    5d.a
    sub[ #w ;  1 , #r 1 - ;  1 , #.chnl.p ;  1 , #.item.p ;  1 , #
       .elem ]
    []copy  becomes>  t9
    t9
    " hor"  h&v.flag  "=
    if
         \        #r   #chnl              #.elem
         \        out  las                inn
      xsect[ #w , ! ,  !      ,    i     , ! ]  []copy
         \ [      1 ,  2                  3 ]
      trans[      1 ,  2  ]                     []copy
    else
         \        #r   #chnl              #.elem
         \        inn  las                out
      xsect[ #w , ! ,  !      ,    i     , ! ]  []copy
      becomes> t8     t8
      trans[      1 ,  2  ]                     []copy
      becomes> t7     t7
      trans[      2 ,  3  ]                     []copy
      becomes> t6     t6
    then
    becomes> 3d.a
    3d.a
    arrange.3d.a.asc
  loop
then
; cr
\ ================================================================
: create.rain.sta.ary.asc
  1  console.flag  =
  if
    console
  then
  \ \** create.rds.a.app
  #.item 1 + 1
  \ 2 1
  do
    i  item.no  :=
    item.no  item.title
    item.name  s.type
    show.flag
    item.no   dup  dup  dup  1 =  4 =  5 =  10 =  or  or  or
    if
```



```
      3 2 fix.format      ."  conf:"  conf.int   .
    then
    item.no   dup  1 =  12 =  or
    if
                          ."  Wnd:"  wnd.str  s.type
      4 0 fix.format      ."  fft:"   i.2  n.type
      1 0 fix.format      ."  sec:("  i.3  n.type  ." *2+1)"
      5 2 fix.format      ."  Freq:"  v.4  n.type  ." --"   v.5  n.type
    then
    item.no  item.format
    cr
    #r   1
    do
      i  case.no  :=
      ."     "  run.c.n   "[ case.no ]   "type   ."   "
      #.chnl 1 +   1
      do
        i  chnl.no  :=
        rds.a [ #w , case.no , chnl.no , item.no ] .
      loop
   \  print out of appended channels
   \  #.c.app 1 +   1
   \  do
   \    i  chnl.no  :=
   \    rds.a.app  [ #w , case.no , chnl.no , item.no ] .
   \  loop
      cr
    loop
    cr
  loop
  cr
  1  console.flag  =
  if
    out>file.cont
  then
  create.3d.a.asc
; cr
\
  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\ ================================================================
integer scalar #.pts
        scalar plt.pts

: a.c.c.plt
  xlyl
  xfyf
  "  xlyl  " s.type

  1000   #.pts    :=   \ for a.c.c
  600    plt.pts  :=   \ for plot
  1      tmp.v.i.2  := \ for initial point #
  \ 1000 tmp.v.i.2  := \ for initial point #
  1      tmp.v.i.3  := \ for a.c.c interval
```

```
  #.pts  tmp.v.i.3 /  tmp.v.i.4  :=                                          961
  datafile.dat.p23  "len  4 -  "left  datafile.dat.p2  ":=
  1st.token sub[ tmp.v.i.2 , #.pts ] a.c.c
  \ sub[ #.pts ,  tmp.v.i.4 ]  swap  sub[ #.pts ,  tmp.v.i.4 ]   swap
  sub[ #.pts ,  tmp.v.i.4 ]  sub[ 1 , plt.pts ]
  swap                                                                       966
  sub[ #.pts ,  tmp.v.i.4 ]  sub[ 1 , plt.pts ]
  swap
  gd
  vertical
        0          2  label.points                                           971
        -1.2  0.0  4  label.format
        10    10      axis.divisions
  axis.on
  -1.   1.   world.set
  horizontal                                                                 976
        0          2  label.points
        -0.5 -1.2  5  label.format
  axis.on
  \  0.    tmp.v.i.4  s.freq /   world.set
  0.    plt.pts     s.freq /   world.set                                     981
  up   1  xy.axis.plot  xydp
       "  Time (sec),  [Up-stream (WG1)] "  " Correlation"    0.02
          labxy.stack
       normal.coords                    0.75  0.85    position
       " Case: "  datafile.dat.p2   "cat               label
  2nd.token    sub[ tmp.v.i.2 , #.pts ] a.c.c                                986
  sub[ #.pts ,  tmp.v.i.4 ]  sub[ 1 , plt.pts ]
  swap
  sub[ #.pts ,  tmp.v.i.4 ]  sub[ 1 , plt.pts ]
  swap
  dp   5  xy.axis.plot  xydp                                                 991
       " Time (sec),  [Down-stream (WG2)]"  " Correlation"    0.02
          labxy.stack
       normal.coords                    0.75  0.85    position
       " Case: "  datafile.dat.p2   "cat               label
       \ hp   datafile.dat.p2  " .acb"  "cat            dump.p.o.stack
       cda                                                                   996
       hp
       datafile.dat.p2  " .pac"  "cat         defer>   vup>pcx
  cdt
;                                                                            1001
\
   ------------------------------------------------------------------------

real  scalar a.v
      scalar b.v
: log.line.bat  \ y = a * x ** b  \ [ slope(b) , lin_# , a , init_x -- ]
             tmp.v.2  :=                                                    1006
             a.v      :=
             lin.#    :=
             b.v      :=
  10
  a.v  **    a.v      :=                                                    1011
```



```
  y.axis.flag  " o"  "=
  if
    7.  real ramp   tmp.v.2  +    \ for log plot
  else
    20. real ramp  8.  /  tmp.v.2  +    \ for linear plot                  1016
  then
  dup
  b.v  **  a.v *
  lin.#  xydp
;                                                                            1021

: log.6    -6.    2   0.1   2.5  log.line.bat   ;
: log.5    -5.    5   0.1   2.5  log.line.bat   ;
: log.4.5  -4.5   4   0.1   2.5  log.line.bat   ;
: log.4    -4.    3   0.1   2.5  log.line.bat   ;                           1026
: log.3.5  -3.5   2   0.1   3.5  log.line.bat   ;
: log.3    -3.    1   0.1   4.5  log.line.bat   ;

: log.line   \ y = a * x ** b
  " Y=A X ** b "  s.type                                                     1031
  "  b :    " s.type
  -6.       get.val  b.v  :=
  " A=10**a <-- a:" s.type
  10
  0.        get.val  **    a.v  :=                                           1036
  "  X_init : " s.type
  1.        get.val   tmp.v.2  :=
  "  line.#" s.type
  2         get.val  lin.# :=
  b.v  lin.#  a.v  tmp.v.2  log.line.bat                                     1041
;

\
   ------------------------------------------------------------------------


: p.s.plt.all                                                                1046
  nd
  datafile.dat.p23  "len  4 -  "left  datafile.dat.p2  ":=
  gd
  ."  OKKK"
\ 1st.token  1  1024   7   " b"   0.1   10.            p.s.plt              1051
  1st.token  1  i.2   i.3   wnd.str   v.4   v.5            p.s.plt
  2nd.token  5  i.2   i.3   wnd.str   v.4   v.5            p.s.plt.lap
  log.3  log.3.5  log.4  log.4.5  log.5

  normal.coords                                                              1056
  0.    0.      position
  world.coords  \  ---> important

  \  datafile.dat.p2  " .psb"  "cat                  dump.p.o.stack
  cda                                                                        1061
    datafile.dat.p2  " .pps"  "cat          defer>   vup>pcx
  cdt
;
```

```
\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

integer scalar ini.pt
        scalar #.pt
1      ini.pt  :=
1000   #.pt    :=
: wt.plt.spe
  cr
  wt.xy.flag
  10  10  axis.divisions
  vertical
         \ grid.off
         axis.on
\        0             1  label.points
\        -1.2  0.0  9  label.format
\        -0.8  0.6  9  label.format
\        -1.0  0.6  6  label.format
\        10    6        axis.divisions
         -6.           6.                                world.set
  horizontal
\        \ grid.off
\        axis.on
\        10  10  axis.divisions
\        0             1  label.points
\        -0.5 -1.2  5  label.format
\        8     12       axis.divisions
\        ini.pt        #.pt                              world.set
         ini.pt        #.pt                              world.set
;

\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\ \ dir.lee.txt  " dwt.txt"  "cat  defer>  load
\ \ 4              n.pwtset   :=
\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: wt.plt
  datafile.dat.p23  "len  4 -  "left  datafile.dat.p2  ":=
  gd
  wt.plt.spe
  up
     xy.axis.plot
     normal.coords
     0.75  0.85    position
     " Case: "  datafile.dat.p2   "cat                 label
     1st.token  1024   1   n.pwtset  wt1
     a
     datafile.dat.p23  "len  3   -  "left  " wt1" "cat    atof.bat
     sub[ ini.pt , #.pt ]
```



```
     []size  ramp  ini.pt +  1 -  swap
     \  " Point series"   "  Wavelet Coefficient"      0.02
        labxy.stack
     " Point series"   "  Wavelet Coeff"      0.02       labxy.stack
     world.coords  \  ---> important
     1 xydp
  dp
     xy.axis.plot
     2nd.token  1024   1  n.pwtset  wt1
     a
     datafile.dat.p23  "len  3   -  "left  " wt2" "cat    atof.bat
     sub[ ini.pt , #.pt ]
     []size  ramp  ini.pt +  1 -  swap
     world.coords  \  ---> important
     2 xydp
     " Point series"   "  Wavelet Coeff"      0.02       labxy.stack
     normal.coords
     0.75  0.85    position
     " Case: "  datafile.dat.p2   "cat                 label
     0.    0.      position
  world.coords  \  ---> important
  cda
  hp
     datafile.dat.p2  " .pwt"  "cat          defer>   vup>pcx
  cdt
;

\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

\
   ----------------------------------------------------------------------------

\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: file.tmpl
  regular.datafile
   file.template
   REAL dim[ s.length ] subfile
   end
;
file.tmpl

: abc.d.p1
  file.tmpl
   f.no.c  ascii"
   DIR.LEE.ASC   "swap  "CAT " .dat" "cat    "dup
   defer>  file.create  defer>  file.open
;
: abc.d.p2
   file.close  f.no.c  1 +  f.no.c  :=
;
: create.abc.dat
  1  96 +   f.no.c   :=  \ " a"
```

```
  abc.d.p1      1 subfile  TOKEN.1  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.2  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.3  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.4  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.5  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.6  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.7  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.8  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.9  array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.10 array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.11 array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.12 array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.13 array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.14 array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.15 array>file   abc.d.p2
  abc.d.p1      1 subfile  TOKEN.16 array>file   abc.d.p2
  cr  ." --- SCROLL data file created ---"
;

\ create.abc.dat
integer scalar clear.flag
: create.ind.dat
  s.chnls 1 +  1
  do
    i
    96 +
    ascii"
    DIR.LEE.ASC   "swap  "CAT " .dat" "cat
    cr "dup    "type
    defer>  file.open
    1 subfile    file>unnamed.array
    file.close

    datafile.dat.p23  "len  3   -  "left

\    i
\    48  +
\    ascii"                        "cat
    i   0  n>s    "cat
    "dup   defer> delete
    atof.bat
    drop  \ <-- clear.flag
  loop

  clear.flag 1 =
  if
  \  s.chnls *drop
  then
;
\ " n"  my.pause.flag ":=

DIR.LEE.TXT  " get-x-n.TXT"  "CAT   defer>  LOAD
parameter.1

DIR.LEE.TXT  " lsta-mai.TXT"   "CAT   defer>  LOAD
```



```
\ DIR.LEE.TXT  " lsta-mai.ASY"   "CAT   defer>  LOAD
\ DIR.LEE.TXT  " lsta-m-e.TXT"   "CAT   defer>  LOAD

\
  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: ref.ana.xeq    \  dummy
;

\ ================================================================
1  abc.mid.flag  :=
\ " y"  h.c.str     :=   \ plot's hard.copy
1  file.no  :=
1  clear.flag :=
\ 0  i.p.c      :=    \ same gp extension --- make.abc
1  i.p.c     :=       \ individual name   --- make.ind  --> .p?
\ ================================================================
: data.sta.xeq
                  cr
                  d.d.o.c   #w .   #r .
                  parameter.2
                  rain.sta  cr
                  create.abc.dat
                  create.ind.dat
                  " ldv"  plot.ext  ":=
                  scr.str  " y"  "=  if
                  else
                    ldv.p.s.plot
                  then
                  wt.flag       1  =  if    wt.plt      then
                  a.c.c.p.flag  1  =  if    a.c.c.plt   then
                  p.s.plt.flag  1  =  if    p.s.plt.all then
  stack.clear
;

: xeq.flag.xeq
  " r"  xeq.flag  "=   if   ref.ana.xeq    then
  " d"  xeq.flag  "=   if   data.sta.xeq    then
;

\ \ Do not use in menu <-- Not enough memory for dictionary!
\ \ dir.asy.sys  " ar-edit.sov"  "cat  defer>  load.overlay
\ \ : aedd
\ \   dir.asy.sys  " ar-edit.sov"  "cat  defer>  load.overlay
\ \   db0   2048 dp>sp +
\ \           array.edit
\ \ \ release.overlay
\ \ ;
\ \ release.overlay

\ %% eps.flag  1 =
\ %% if
\ %% else  gd
\ %% then
\ %% hp
```

```
dir.lee.txt  " def-ana3.3sp"  "cat   defer> load
\ dir.lee.txt  " get-s-ch.txt"                          "cat   defer>
   load
                                                                      1271
{mes.wnd}
1  file.no  :=
sta.or.ana.xeq
nd
: menu.word                                                           1276
  menu.flag  0 =
  if
    view.str  " y" "= if  DIR.LEE.TXT  " SCR-new.TXT"  "CAT  defer> LOAD
       then
  else
    non.stop.str  " n"  "=                                            1281
    view.str  " y"      "=
    scr.str  " y"       "=  or   and
    if  DIR.LEE.TXT  " SCR-n-m.TXT"  "CAT  defer> LOAD then

    \    forget/clr  lsta-0                                           1286
    axis.defaults
    forget  lsta-0
  then
  bell.3dn
;                                                                     1291

menu.word
cdt
```

LREF-0.TXT

A01808-20161220-A011 ❖ December 20, 2016 ❖ [Page count: 2]

```
\ : lref-0 ; & : lplt-0 ;                                                    1
\ ================================================================
\
\ Keywords       :  1. Wav-anaa.all
\                   2.
\                                                                            6
\ Written        :  Nov. 1993 by  Y-R Lee  (updated Feb. 1994)
\ ================================================================
" r"    xeq.flag  ":=
echo.off
1 29.flag :=                                                                11
: menu.word
  menu.flag 0 =
  if
    forget.all
  then                                                                      16
; menu.word
: lcom-0 ;

integer scalar  smo.flag
: menu.word                                                                 21
  menu.flag 0 =
  if
    dir.lee.txt   " def-winn.nam"  "cat   defer> load
    dir.lee.txt   " def-acqn.nam"  "cat   defer> load
    dir.lee.txt   " def-anan.nam"  "cat   defer> load                       26
  \  dir.lee.txt   " def-acqs.spe"  "cat   defer> load
  \  dir.lee.txt   " def-ana1.1sp"  "cat   defer> load
  then
  dir.lee.txt   " def-acqs.spe"  "cat   defer> load
  dir.lee.txt   " def-ana1.1sp"  "cat   defer> load                         31
  \  1  smo.flag  :=
  dir.lee.txt   " def-anaT.Tsp"  "cat   defer> load
  dir.lee.txt   " lcri.cri"      "cat   defer> load
; menu.word
                                                                            36
input.case.flag

dir.lee.txt   " Coef-" "cat   " gp"      "cat   " .dat" "cat   defer> load
\  put    " eee"   " r03"   " h01"   " ldv"   ....  on stack
dir.lee.txt   " Coef-" "cat   " gp"      "cat   " .txt" "cat   defer> load   41
\  check exist or not
dir.lee.txt   " Coef-" "cat  cnst.flag  "cat   " .dat" "cat   defer> load
dir.lee.txt   " get-s-ch.txt"                          "cat   defer> load
dir.lee.txt   " def-pre.txt"                           "cat   defer> load
{29.line}                                                                   46

: create.rain.sta.ary.asc ;         \ dummy

: data.sta.xeq     \ dummy word
;                  \ reset at data-sta.bat                                  51
```



```
: wave.ana.xeq
  " ind"  case.flag  "=
  if
       datafile.dat.p2  "dup                                                56
  else          \  <--- [ file name - ]
       "dup
  then
                dir.lee.asc "swap "cat    " .prn"  "cat    defer> delete
                dir.lee.dat "swap "cat    " .dat"  "cat    datafile.dat    61
                   ":=
  \  xeq.flag  " r"  "=
  \  if   dir.lee.txt " lref-mai.txt"       "cat    defer> load   then
  \  xeq.flag  " p"  "=
  \  if   dir.lee.txt " lplt-mai.txt"       "cat    defer> load   then
                dir.lee.txt " lref-mai.txt"       "cat    defer> load     66
;

\
  ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

: xeq.flag.xeq
  \ nd                                                                      71
  " r"  xeq.flag  "=   if   wave.ana.xeq   then
  " p"  xeq.flag  "=   if   wave.ana.xeq   then
  " d"  xeq.flag  "=   if   data.sta.xeq   then
;                                                                           76
dir.lee.txt   " def-ana3.3sp"  "cat   defer> load

sta.or.ana.xeq

\ dir.asy.sys  " ar-edit.sov"  "cat  defer>  load.overlay                   81
\ : aedd
\   dir.asy.sys  " ar-edit.sov"  "cat  defer>  load.overlay
\   db0   2048 dp>sp +
\           array.edit
\  \ release.overlay                                                        86
\ ;
\  release.overlay

: menu.word
  menu.flag 1 =                                                             91
  if
    forget lcom-0
  then
  bell.3dn
  \  500 msec.delay                                                        96
; menu.word
cdt
\ sc
```

LWHP-0.TXT

A01809-20161220-A012 ❖ December 20, 2016 ❖ [Page count: 12]

```
\ lwhp-0                                                                    1
\ ==================================================================
\
\ Keywords       :  1. Drift of mean water level correctable
\                   2. Data statistics
\                                                                           6
\ Written        :  Mar. 1994  by  Y-R Lee
\ ==================================================================

echo.off
1 29.flag :=                                                               11
: menu.word
  menu.flag 0 =
  if
    forget.all
  then                                                                     16
; menu.word
: lwhp-0 ;

" w"       xeq.flag     ":=
                                                                           21
: menu.word
  menu.flag 0 =
  if
    dir.lee.txt   " def-winn.nam"  "cat   defer> load
    dir.lee.txt   " def-acqn.nam"  "cat   defer> load                      26
    dir.lee.txt   " def-anan.nam"  "cat   defer> load
\    dir.lee.txt   " def-acqs.spe"   "cat   defer> load
\    dir.lee.txt   " def-ana1.1sp"   "cat   defer> load
  then
   dir.lee.txt   " def-acqs.spe"  "cat   defer> load                       31
   dir.lee.txt   " def-ana1.1sp"  "cat   defer> load
  \  1  smo.flag  :=
  dir.lee.txt   " def-anaT.Tsp"  "cat   defer> load
  dir.lee.txt   " lcri.cri"      "cat   defer> load
; menu.word                                                                36

" .whp"   file.ext     ":=
input.case.flag
dir.lee.txt   " Coef-" "cat   " gp"       "cat   " .dat" "cat    defer> load
\  put    " eee"   " r03"   " h01"   " ldv"   ....  on stack                41
dir.lee.txt   " Coef-" "cat   " gp"       "cat   " .txt" "cat    defer> load
\  check exist or not
dir.lee.txt   " Coef-" "cat  cnst.flag  "cat   " .dat" "cat    defer> load
dir.lee.txt   " get-s-ch.txt"                          "cat    defer> load
{29.line}                                                                  46
\ ------------------------------------------------------------------
: show.flag
  get.forced.spe.whp
  1 0 fix.format  ."  ("
  ."  f"  smo.flag  0 n>s  s.type  ."  p"  smo.p       0 n>s  s.type        51
  ."  e"  coef.flag 0 n>s  s.type  ."  s"  shif.flag  0 n>s  s.type
```



```
  \ ."  w"  wnd.str           s.type
  ."  )"
;
\ !----------------------------------------------------------------        56
   Simulated spectrum
real scalar Amp.i.s
     scalar Amp.r.s
     scalar x.pos.1
     scalar x.pos.2
     scalar phase                                                          61

: compute.wave.length            \  You should provide: w.l.o g.depth
   tmp.period
                                 \  Accelerated Newton Method
  {  2pid     := 2 * pi * g.depth                          }
  {  gtt/2pi  := gravity * tmp.period ** 2 / 2 / pi        }               66
  {  gttd     := gravity * tmp.period ** 2 *  g.depth      }
  {  w.l.o    := gtt/2pi     }     \  place outside to improve efficiency
    for FFT
  begin
    {  2pid/l := 2pid / w.l.o
                                                          }
    {  w.l.n  := w.l.o - ( w.l.o - gtt/2pi * tanh ( 2pid/l ) ) /           71
                         ( 1 + gttd / w.l.o ** 2 * sech ( 2pid/l ) ** 2
                           ) }
    w.l.n  w.l.o  -  abs  w.l.o /   epslon  <
    w.l.n  w.l.o  :=
  until
;                                                                          76

\ ==================================================================
\ ^----------------------------------------------------------------
   Simulated spectrum
\ ==================================================================
                                                                           81
\ \datafile.asc defer> delete
\ \datafile.prn defer> delete

token w.h.ary
token w.p.ary                                                              86
exp.mem>  w.h.ary
exp.mem>  w.p.ary

: out.of.index
  index 1 + array.size >                                                   91
;

: H.s.c    \ H.scale.conversion   \  [ Int-val  ,  Real-practical-val ]
  dig.to.h  *
;                                                                          96

: T.s.c    \ T.scale.conversion   \  [ Int-val  ,  Real-practical-val ]
  float     s.freq float    /
;
                                                                          101
```

```
: index.p.1
    index  1 +  index   :=
;

\                                                                                106
   ------------------------------------------------------------------------------


: raw.exp.ana     \ 1
   ..........................................................1
  tmp.v.i  :=
  tmp.v.i  channel.const
  tmp.v.i  smooth.spe                                                            111
  get.forced.spe.whp
  real n.of.w  ramp   becomes>   w.h.ary
                      0          w.h.ary  :=
            w.h.ary   becomes>   w.p.ary
                                                                                 116
  shift.raw.data
  conv.formula
  smooth.xeq   becomes> a.token
  a.token  []size  swap drop  array.size  :=
                                                                                 121
  0 index :=
  0 i.count :=

  begin
   index.p.1                                                                     126
   a.token [ index ]  sgn    0  >          \   set to zero down crossing
   index  array.size            >=    or
  until

  index  array.size  <                                                           131
  if
    a.token [ index ]  sgn
    begin
        index.p.1
        a.token [ index ]  sgn  dup rot  <>                                      136
        dup                     0        <>    and
        index  array.size               >=    or
    until
        index  left.index        :=
        dup    zero.up.or.down   :=                                            141
  then
  \  cr  ." left.index"    left.index .

  begin    \
     !2-------------------------------------------------------------------!2
  index  array.size  <                                                           146
    if
      begin
        index.p.1
        a.token [ index ]  sgn  dup rot  <>
        dup                     0        <>    and                               151
        dup    zero.up.or.down           =     and
```



```
        index  array.size               >=    or
      until
      index       right.index :=
    then                                                                         156

    index  array.size  <
    if
      i.count  1 +   i.count :=
      \ cr ." right.index=  "    right.index .                                   161
      \ cr ." i.count=  "        i.count     .
      right.index left.index -                  w.p.ary [ i.count ] :=
      a.token sub[ left.index ,   right.index left.index -  ]
      []min/max  swap -                          w.h.ary [ i.count ] :=
                                                                                 166
      right.index left.index  :=
    then

  index array.size  >=
  until   \                                                                      171
     ^2-------------------------------------------------------------------^2


  i.count  0  >
  if
     drop
  then                                                                           176
  \ cr ." i.count ="   i.count  .   ."              ch = "  i  .

  i.count 0 >
  if
    \  i.count     n.of.w.ary  [ 1 , i ]  :=                                     181
    w.p.ary    t.s.c    w.p.ary   :=  \ pratical unit
  then
; \ ^1
   ..........................................................................
   ^1

: w.h.sort&index   \ !3                                                          186
   ..........................................................!3
  i.count 10 /          1/10.index          :=  \  cr 1/10.index  .
  i.count 3  /          1/3.index           :=  \  cr 1/3.index   .
  i.count 2  /          1/2.index           :=  \  cr 1/2.index   .

  1/10.index 0 >                                                                 191
  if
    1  tmp.v.i  :=
    real  i.count  ramp    becomes>  a.token

    w.h.ary  sub[ 1 , i.count ]    sort&index                                    196

    rev[ 1 ]
      begin  \  w.p stored in accordance with w.h in descent order
        dup  [ tmp.v.i ]     tmp.v.i.2  :=
        w.p.ary [ tmp.v.i.2 ]     a.token [ tmp.v.i ]  :=                        201
        tmp.v.i  i.count  >=
```

```
        tmp.v.i  1 +   tmp.v.i  :=
      until
    drop
    a.token  ^sum                                                    206
      dup  [ 1/10.index ]       1/10.index  /  1/10.w.p :=
      dup  [ 1/3.index  ]       1/3.index   /  1/3.w.p  :=
      dup  [ 1/2.index  ]       1/2.index   /  1/2.w.p  :=
           [ i.count    ]       i.count     /  ave.w.p  :=
                                                                     211
    rev[ 1 ]   \ dup   w.h.token  :=
    ^sum
      dup  [ 1/10.index ]       1/10.index  /  1/10.w.h :=
      dup  [ 1/3.index  ]       1/3.index   /  1/3.w.h  :=
      dup  [ 1/2.index  ]       1/2.index   /  1/2.w.h  :=           216
           [ i.count    ]       i.count     /  ave.w.h  :=

    1  tmp.v.i  :=
    0. tmp.v    :=
    0. tmp.v.2  :=                                                   221
    begin
      tmp.v    w.h.ary   [ tmp.v.i ]  2. **  +       tmp.v   :=
      tmp.v.2  w.p.ary   [ tmp.v.i ]  2. **  +       tmp.v.2 :=
      tmp.v.i  1 +    tmp.v.i   :=
      tmp.v.i  i.count >                                             226
    until
    tmp.v    i.count / sqrt                 rms.w.h  :=
    tmp.v.2  i.count / sqrt                 rms.w.p  :=

  then                                                               231
;  \ ^3
   ..........................................................................
   ^3

\ ====================================================================
token  wha  exp.mem>  wha
token  wpa  exp.mem>  wpa                                            236
: wh.wp
        dup  1  +   swap
        \     s.chnls 1 +   1
        DO
        \ db0     xsect[ ! , i ]                                     241
          i  get.chan.data
          i  raw.exp.ana
          \ a.token  []size  swap drop  array.size  :=
                  i.count 0 <=
                  if                                                 246
                  4 0 fix.format  i  float . 5 0 fix.format   i.count
                     n.type \ .
                  ."    ------- No complete wave cycle  --------"
                  then

          i.count 0 >                                                251
          if
            w.h.sort&index
            1/10.index 0 <=
```



```
            if
                  4 0 fix.format i  float  .  5 0 fix.format  i.count   256
                     n.type \ .
                  ."    ------- Too small number of waves ------"
            then

            1/10.index 0 >
            if                                                         261
                  4 0 fix.format i  float  .  5 0 fix.format  i.count
                     n.type \ .
                  \ =w.h.token  sort  rev[ 1 ]
                  w.h.ary  sub[ 1 , i.count ]  sort  rev[ 1 ]
                  wh.format
                                dup  [ 1 ]                      .    266
                                dup  [ 2 ]                      .
                                     [ 3 ]                      .  2
                                     spaces
                  1/10.w.h  .   1/3.w.h  .  1/2.w.h  .  ave.w.h  .
                     rms.w.h  .
                  3 spaces
                  6 2 fix.format                                       271
                  1/10.w.p  .   1/3.w.p  .  1/2.w.p  .  ave.w.p  .
                     rms.w.p  .
            then

          then
          cr                                                           276
        loop

  i.count  0  =
  if
    w.h.ary                      becomes>  wha                       281
    w.p.ary                      becomes>  wpa
  else
    w.h.ary  sub[ 1 , i.count ]  becomes>  wha
    w.p.ary  sub[ 1 , i.count ]  becomes>  wpa
  then                                                               286
;

: whwp.for.rain.proposal
        whwp.flag  " wha"  "=
         if                                                          291
           token.2
           datafile.dat.p23  "len  3 -  "left  " 2wh" "cat  atof.bat
              drop
           token.3
           datafile.dat.p23  "len  3 -  "left  " 3wh" "cat  atof.bat
              drop
         else                                                        296
           token.2
           datafile.dat.p23  "len  3 -  "left  " 2wp" "cat  atof.bat
              drop
           token.3
           datafile.dat.p23  "len  3 -  "left  " 3wp" "cat  atof.bat
              drop
```

```
          then                                                                  301
;

: creat.datafile.prn       \ on site print out of wave statistics
  datafile.prn  defer>  delete
  datafile.prn  defer>  out>file  1 out>file.flag  :=  echo.off  \          306
     console off
  cr mycase       s.type
  show.flag
  cr mydate       "type    5 0 fix.format
  cr mytime       "type    68  mytime  "len  -  spaces              "drop
  ." Sampling   frequency  :"   s.freq              .   ."  Hz"          311
  cr specifics    "type    68  specifics  "len  - spaces              "drop
  ." Sampling time length  :"   s.length s.freq /   .   ."  Sec"
  cr      cr  \     cr

\   ."  Ch   #_W    H.1    H.2    H.3    H1/10   H1/3   H1/2  H.ave        316
    H.rms"
\    3 spaces
\                                    ."  T1/10  T1/3  T1/2 T.ave
    T.rms"
  ."  Ch   #_W"   ."    "
  "  H.1    H.2    H.3    H1/10   H1/3   H1/2  H.ave  H.rms" s.type
  3 spaces                                                                  321
                       "  T1/10  T1/3  T1/2 T.ave T.rms"  s.type
  cr  cr
  s.chnls 1 +   1
  do
          i  wh.wp                                                          326
          whwp.flag  " wha"  "=    if  wha  else  wpa  then
          i  array.to.token
  loop
  my.out>file.close
  \ \\ whwp.for.rain.proposal                                               331
;

\ normal.display

-1 4 fix.format                                                             336
7 set.file.parse
cdt
\
    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^


\                                                                           341
    ************************************************************************


token    rds.a
exp.mem> rds.a
token    freq.a
exp.mem> freq.a                                                            346

integer dim[ 1 , #.case , #.chnl , #.item ] unnamed.array  0.  * becomes
```



```
   > rds.a
\       dim[ 2 , #.case , #.chnl , #.item ] unnamed.array  0.  * becomes
   > rds.a

\ dir.asy.sys  " spfn.sov"  "cat  defer> load.overlay                       351
: rain.sta
\  dir.asy.sys  " spfn.sov"  "cat  defer> load.overlay
  \  #r :=
  \  #w :=
  deg.fre  300  >                                                           356
  if  300  deg.fre  :=
  then

  without.frequencies
  cr                                                                        361
  #.chnl  1 +   1
  do
    i  chnl.no  :=                    \ channel No.
    chnl.no  .                          \ channel No.
    chnl.no  get.token                                                      366
    dup                                 []size  tmp.v.i   :=
    tmp.v.i  2  >=
    if

    \ freq.a                                                                371
    mean                    dup                 std.mea   :=
                      rds.a [ #w , #r , chnl.no , 1  ]  :=  \ mean

    chnl.no  channel.const
    get.forced.spe.whp                                                      376
    chnl.no  smooth.spe
    \    db0 xsect[ ! , chnl.no ]
    chnl.no  get.chan.data
    shift.raw.data
    conv.formula   \ becomes>   a.token                                     381
    smooth.xeq

    dup   mean  tmp.v.2  :=
    []size   tmp.v.i.2  :=
    tmp.v.2  dp>sp  -  dup  *  []sum   tmp.v.i.2  /                         386
\                     rds.a [ #w , #r , chnl.no , 11 ]  :=  \ spectrum
   integral
                      rds.a [ #w , #r , chnl.no , 12 ]  :=  \ spectrum
                         integral

    dup
    dup   mean  tmp.v.2  :=                                                 391
    []size   tmp.v.i.2  :=
    tmp.v.2  dp>sp  -  dup  *  []sum   tmp.v.i.2  /
                      rds.a [ #w , #r , chnl.no , 11 ]  :=  \ rms**2
    dup
    \ ----- no more than 11000 elements due to Memory                       396
    sub[ 1 , 10500 ]
    sample.variance sqrt    dup                 std.dev   :=
                      rds.a [ #w , #r , chnl.no , 2  ]  :=  \ std.  dev.
```

```
    std.dev  tmp.v.i sqrt / dup                std.err   :=                  401
                      rds.a [ #w , #r , chnl.no , 3  ]  :=  \ std.
                         error
    1.    1. conf.int - 2. /  -   \ confidence interval fractile
          deg.fre   student-t.fractile
          std.err *  dup  2 *
                      rds.a [ #w , #r , chnl.no , 10 ]  :=  \ conf. int.  406
                         range
                    dup     std.mea       +   conf.l.u   :=
                            std.mea  swap -   conf.l.l   :=
    conf.l.u          rds.a [ #w , #r , chnl.no , 4  ]  :=  \
    conf.l.l          rds.a [ #w , #r , chnl.no , 5  ]  :=  \
    tmp.v.i           rds.a [ #w , #r , chnl.no , 6  ]  :=  \ []size      411
    std.mea tmp.v.i * rds.a [ #w , #r , chnl.no , 7  ]  :=  \ total
    []min/max         rds.a [ #w , #r , chnl.no , 8  ]  :=  \ max
                      rds.a [ #w , #r , chnl.no , 9  ]  :=  \ min

    else                                                                    416
    mean                      dup               std.mea   :=
                      rds.a [ #w , #r , chnl.no , 1  ]  :=  \ mean
    tmp.v.i           rds.a [ #w , #r , chnl.no , 6  ]  :=  \ []size
    std.mea tmp.v.i * rds.a [ #w , #r , chnl.no , 7  ]  :=  \ total
    []min/max         rds.a [ #w , #r , chnl.no , 8  ]  :=  \ max       421
                      rds.a [ #w , #r , chnl.no , 9  ]  :=  \ min
    then
  loop

  #r  1 +  #r :=                                                            426
\ release.overlay
;
\ release.overlay

: d.d.o.c                                                                   431
  tmp.s    ":=
  tmp.s     run.c.n    "[ #r ]   ":=
  \  d.d.o
  tmp.s dir.lee.asc  "swap "cat   " .pr2" "cat  datafile.prn   ":=
  tmp.s dir.lee.asc  "swap "cat   " .asc" "cat  datafile.asc   ":=          436
  tmp.s                                       datafile.dat.p2  ":=
  tmp.s dir.lee.dat  "swap "cat   " .dat" "cat  defer> file.open
  1 comment>    mycase            ":=
  2 comment>    mydate            ":=
  3 comment>    mytime            ":=                                       441
  4 comment>    specifics         ":=
  5 comment>    datafile.dat.p23  ":=
  1 subfile     acq.input  file>array
                acq.input  [ 1 ]     t.rate    :=
                acq.input  [ 2 ]     s.length  :=                           446
                acq.input  [ 3 ]     s.freq    :=
                acq.input  [ 4 ]     s.chnls   :=

  acq.input [ 1 ]  0  >
  if                                                                        451
    0     #.times  :=
```



```
    2 subfile    file>unnamed.array     becomes>  db0
  else
    acq.input [ 5 ]             #.times  :=
  then                                                                      456
  file.close
  s.length      deg.fre            :=
  integer  dim[ s.length         ] unnamed.array  1. *  becomes> freq.a
  1. freq.a :=
\  datafile.prn  defer>  delete                                             461
\  datafile.prn  defer>  out>file       echo.off  \   console.off
  creat.datafile.prn
  cr  cr  \ two blank lines
\  out>file.close
  5 0 fix.format                                                            466
;
\ ================================================================

: create.rain.sta.ary.asc
  12      #.item  :=                                                        471
  xeq.flag  " d"   "=  if  #.item 1 + 1   then
  xeq.flag  " w"   "=  if  #.item     1   then
\  ||  xeq.flag  " w"   "=  if  #.item 1 + 1   then
  \ 2 1
  do                                                                        476
    i  item.no  :=      \  item.no .
    item.no  item.title
    item.name  s.type
    4 2 fix.format ."  conf="  conf.int   .
                                                                            481
    show.flag
    item.no  item.format
    cr
    #r   1
    do                                                                      486
      i  case.no  :=
      ."      "   run.c.n   "[ case.no ]   "type   ."   "
      #.chnl 1 +   1
      do
        i  chnl.no  :=                                                      491
        rds.a [ #w , case.no , chnl.no , item.no ] .
      loop
      cr
    loop
    cr                                                                      496
  loop
  cr
; cr

\ ================================================================        501

: whp.p
  ." #    ' a/d' "
  dup
  case                                                                      506
  1   of  token.1   endof
```

```
  2   of   token.2    endof
  3   of   token.3    endof
  4   of   token.4    endof
  5   of   token.5    endof
  6   of   token.6    endof
  7   of   token.7    endof
  8   of   token.8    endof
  9   of   token.9    endof
  10  of   token.10   endof
  11  of   token.11    endof
  12  of   token.12    endof
  13  of   token.13    endof
  14  of   token.14    endof
  15  of   token.15    endof
  16  of   token.16    endof
  endcase
  sort&index   drop   rev[ 1 ]   swap
  " a"   "=  if     yap
            else   ydp
            then
;

: whp.plt
  " array , line_#  ,  '' a/d'' "  s.type
  swap
  sort&index   drop   rev[ 1 ]   swap
  " a"   "=  if     yap
            else   ydp
            then
;

DIR.LEE.TXT  " get-x-n.TXT"  "CAT   defer>  LOAD
parameter.1
\ dir.lee.txt   " lwhp-m03.txt" "cat defer> LOAD
dir.lee.txt  " lwhp-mai.txt" "cat defer> LOAD

\
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: ref.ana.xeq    \  dummy
;

\ ==============================================================
1  abc.mid.flag  :=
\ " y"  h.c.str     :=   \ plot's hard.copy
1  file.no  :=
\ 1  clear.flag :=
\ 0  i.p.c      :=    \ same gp extension --- make.abc
1  i.p.c     :=       \ individual name   --- make.ind  --> .p?
\ ==============================================================
\ ==============================================================

: ref.ana.xeq    \  dummy
;
```



```
: data.sta.xeq
                cr
                d.d.o.c   #w .   #r .
                rain.sta  cr

                whp.d.plot
                stack.clear
;

: xeq.flag.xeq
  nd
  " r"  xeq.flag  "=   if   ref.ana.xeq    then
  " d"  xeq.flag  "=   if   data.sta.xeq   then
  " w"  xeq.flag  "=   if   data.sta.xeq   then
;

dir.lee.txt  " def-ana3.3sp"  "cat   defer> load
nd
sta.or.ana.xeq

: menu.word
  menu.flag 1 =
  if
    axis.defaults
    forget lwhp-0
  then
  bell.1sl  bell.1sl
  \  500 msec.delay
; menu.word
cdt
```

LPLT-0.TXT

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```
\ : lref-0 ; & : lplt-0 ;
\ ==================================================================
\
\ Keywords       :  1. Wav-anaa.all
\                   2.
\
\ Written        :  Nov. 1993 by  Y-R Lee  (updated Feb. 1994)
\ ==================================================================
" p"    xeq.flag   ":=
echo.off
1 29.flag :=
: menu.word
  menu.flag 0 =
  if
    forget.all
  then
; menu.word
: lcom-0 ;

integer scalar  smo.flag
: menu.word
  menu.flag 0 =
  if
    dir.lee.txt  " def-winn.nam"  "cat   defer> load
    dir.lee.txt  " def-acqn.nam"  "cat   defer> load
    dir.lee.txt  " def-anan.nam"  "cat   defer> load
  \  dir.lee.txt  " def-acqs.spe"  "cat   defer> load
  \  dir.lee.txt  " def-ana1.1sp"  "cat   defer> load
  then
  dir.lee.txt  " def-acqs.spe"  "cat   defer> load
  dir.lee.txt  " def-ana1.1sp"  "cat   defer> load
  \  1  smo.flag  :=
  dir.lee.txt  " def-anaT.Tsp"  "cat   defer> load
  dir.lee.txt  " lcri.cri"      "cat   defer> load
; menu.word

: tmp.word
  menu.flag 0 =
  if
    cr ." Non stop execuation (y/n)? "  " n"  get.str   non.stop.str
       ":=
  then
;
\  %% tmp.word  --- Placed in
tmp.word

input.case.flag
dir.lee.txt  " Coef-" "cat  " gp"      "cat  " .dat" "cat   defer> load
\  put   " eee"  " r03"  " h01"  " ldv"  ....  on stack
dir.lee.txt  " Coef-" "cat  " gp"      "cat  " .txt" "cat   defer> load
\  check exist or not
dir.lee.txt  " Coef-" "cat  cnst.flag  "cat  " .dat" "cat   defer> load
```



```
dir.lee.txt  " get-s-ch.txt"                          "cat   defer> load
{29.line}

: create.rain.sta.ary.asc ;         \ dummy

: data.sta.xeq     \ dummy word
;                  \ reset at data-sta.bat

\ 1 eps.flag :=

: wave.ana.xeq
  " ind"  case.flag  "=
  if
       datafile.dat.p2  "dup
  else          \  <--- [ file name - ]
       "dup
  then
                 dir.lee.asc "swap "cat   " .prn"  "cat    defer> delete
                 dir.lee.dat "swap "cat   " .dat"  "cat    datafile.dat
                    ":=
  \  xeq.flag  " r"  "=
  \  if   dir.lee.txt " lref-mai.txt"      "cat    defer> load   then
  \  xeq.flag  " p"  "=
  \  if   dir.lee.txt " lplt-mai.txt"      "cat    defer> load   then
\  1  eps.flag  =
\  if
\              dir.lee.txt " lref-m-e.txt"       "cat    defer> load
\  else
                 dir.lee.txt " lref-mai.txt"      "cat    defer> load
\  then
;

\  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

: xeq.flag.xeq
  \ nd
  " r"  xeq.flag  "=  if   wave.ana.xeq   then
  " p"  xeq.flag  "=  if   wave.ana.xeq   then
  " d"  xeq.flag  "=  if   data.sta.xeq   then
;

dir.lee.txt  " def-ana3.3sp"  "cat   defer> load

sta.or.ana.xeq

dir.asy.sys  " ar-edit.sov"  "cat  defer>  load.overlay
: aedd
  dir.asy.sys  " ar-edit.sov"  "cat  defer>  load.overlay
  db0   2048 dp>sp +
            array.edit
\ release.overlay
;
release.overlay
```

```
: menu.word
  menu.flag 1 =
  if                                                    106
    axis.defaults
    forget lcom-0
  then
  bell.3dn
  \   500 msec.delay                                   111
; menu.word
\ sc
cdt
```

MON.men

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```
\ ---- plea egula t file      MONITERING       N        (c) Lee Yueon-Ron     1
   ------- \

\ Written             May, 1990  by Lee  (02/20/94)

\ 0 set.file.parse
echo.off normal.display screen.clear                                          6
\ forget.all   \ Be aware of the removal of all previous data and words.

: forget.word.acq
;
\ \ dir.lee.txt  " bell.txt"       "cat   defer> load                        11
\ dir.lee.txt  " pre-file.nam"  "cat   defer> load
  cdt load pre-file.nam
  screen.clear lower.inner.wnd  {border}
\ \ dir.lee.txt  " def-acqn.nam"  "cat   defer> load
\ \ dir.lee.txt  " def-mons.spe"  "cat   defer> load                          16
\ \  dir.lee.txt  " def-acqs.spe"  "cat   defer> load

\  dir.lee.txt  " def-acqs.sp2"  "cat   defer> load
\ \  dir.lee.txt  " def-anan.nam"  "cat   defer> load
\ \  dir.lee.txt  " def-ana1.1sp"  "cat   defer> load                         21
\  get.acq.spe
\  nd chk.file.str s.type  my.pause
dir.lee.txt  " filepass.asy"   "cat    filepass.asy   ":=

 1   1   17   78   window show.wnd                                            26
8  string  tmp.s.2
: chnls.in ;
: chnl.plot ;

: get.acq.input                                                               31
\ screen.clear
  14  foreground
\  inv.on
\  19 3  goto.xy  ."              WELCOME                  "   inv.of
  19 3  goto.xy   "              WELCOME                     "                36
     s.type.3
  19 5  goto.xy  ."   Channel          :              (1~16) "
  19 6  goto.xy  ."   Sampling Rate    :                 Hz "
  19 8  goto.xy  ."   Gain factor      :                    "
  19 9  goto.xy  ."   Plot Lower bound :                    "
  19 10 goto.xy  ."   Plot Upper bound :                    "                41
  em.color foreground
  5  0  fix.format
  46 5  goto.xy    s.chnls          get.val  s.chnls          :=
  46 6  goto.xy    s.freq           get.val  s.freq          :=
  7  3 fix.format                                                            46
  46 8  goto.xy    v.to.h           get.val  v.to.h          :=
  46 9  goto.xy    gra.lower.lim    get.val  gra.lower.lim   :=
  46 10 goto.xy    gra.upper.lim    get.val  gra.upper.lim   :=
  s.chnls   p.chnl  :=
```



```
  9  4  fix.format                                                           51
  s.dura  s.freq  *   s.length :=

  my.def.colors
  cr
                                                                            56
\   -5.     gra.lower.lim   :=
\    5.     gra.upper.lim   :=
\    1.     v.to.h          :=   \ linear factor
    gra.lower.lim   v.to.h /  vol.lower.lim  :=
    gra.upper.lim   v.to.h /  vol.upper.lim  :=                             61

  cr
  \ ." To reenter, Press <F>."
  \ ."                              To continue, Press <non-F>"
  10 15 goto.xy                                                             66
  ."    Reenter:"          " <F>"      s.type.3
  ."    Continue:"         " <non-F>"  s.type.3
  \    ." To reenter  : Press <F>"
  \  cr ."    continue : Press <non-F>"
  bell.2sl                                                                  71
  pckey drop if myself then
;
: data.filename.input
  \
  bell.2sl                                                                  76
  pre.file.name   \ -> old datafile.dat
  \
  lower.wnd \  screen.clear
  \  int.on  inv.on
  inv.on                                                                    81
  4  3  goto.xy  ." Please input CASE name    :          "
  33 3  goto.xy
  s.input  datafile.dat.p2  ":=
  \  inv.of  int.of       lower.inner.wnd
  inv.of         lower.inner.wnd                                            86
  cr
  10 15 goto.xy
  ."    Reenter:"          " <F>"      s.type.3
  ."    Continue:"         " <non-F>"  s.type.3
  \   ."                                  To reenter,  Press <F>."  cr      91
  \   ."                                 To continue, Press <non-F>."
  bell.2sl
  pckey drop if    myself  then
  re.or.ir.tes
;                                                                           96

: default.acq.input
  nd      show.wnd   {border}
  screen.clear
  \ int.on                                                                 101
  14  foreground
\  inv.on
\  19 3  goto.xy  ."              WELCOME                  "
   inv.of
```

```
  19 3  goto.xy    "                 WELCOME                          "
    s.type.3
  19 5  goto.xy  ."   Channel           :                 (1~16)  "
  19 6  goto.xy  ."   Sampling Rate     :                     Hz  "
  19 8  goto.xy  ."   Gain factor       :                         "
  19 9  goto.xy  ."   Plot Lower bound  :                         "
  19 10 goto.xy  ."   Plot Upper bound  :                         "
  em.color  foreground
  5 0 fix.format
  46 5  goto.xy    s.chnls          n.type
  46 6  goto.xy    s.freq           n.type
  7 3 fix.format
  46 8  goto.xy    v.to.h           n.type
  46 9  goto.xy    gra.lower.lim    n.type
  46 10 goto.xy    gra.upper.lim    n.type
  my.def.colors

  datafile.dat.p2  tmp.s     ":=
  specifics        tmp.s.2   ":=

  cr
  cr cr

  10 15 goto.xy
  ."    Reenter:"          " <F>"       s.type.3
  ."    Continue:"         " <non-F>"   s.type.3
  bell.2sl
  pckey drop if    get.acq.input  then
;
nd
\ data.filename.input

\ dir.lee.txt " def-acq.spe" defer> load
default.acq.input
lower.wnd {border}
dir.lee.dat  datafile.dat.p2  "cat  " .dat"   "cat  datafile.dat  ":=

1000.  s.freq / t.rate :=
s.freq 2 * p.points :=      \ osscilloscope display set to every two
   seconds

1 low.f.modulo   :=
: find.t.rate               \ for low frequency acq
  t.rate   53   >
  if
  t.rate       2 /      t.rate        :=
  low.f.modulo 2 *      low.f.modulo  :=
  t.rate   53   >
    if
      myself
    then
  then
;
find.t.rate
```



```
  INTEGER DIM[ p.points ] ARRAY db1        \ buffer for plotted points
  INTEGER DIM[ p.points ] ARRAY db2
  INTEGER DIM[ p.points ] ARRAY db3        \ buffer for plotted points
  INTEGER DIM[ p.points ] ARRAY db4
\ integer dim[ s.length , s.chnls ] array db0
                                           \ buffer for raw data

\ s.chnls 1 - 0 swap  A/D.TEMPLATE CHNLs.IN      \ template for input on
s.chnls 1 -   s.chnls 1 -  swap  A/D.TEMPLATE CHNLs.IN
\ db0   TEMPLATE.BUFFER                  \ channels ( 1 --> 16 )
db3  db4  CYCLIC DOUBLE.TEMPLATE.BUFFERs

p.chnl 1 - dup  A/D.TEMPLATE CHNL.plot         \ template for
   oscilloscope
db1  db2  CYCLIC DOUBLE.TEMPLATE.BUFFERS

: START.ACQ                                    \ start acquisition
   CLEAR.TASKS

       CHNLs.IN A/D.INIT
       1 TASK A/D.IN>ARRAY
       \       s.length 1 task.iterations
       1 task a/d.in>array
       low.f.modulo   1   task.modulo

       chnl.plot a/d.init
       2 task a/d.in>array
       1 2 task.deactivated.by
       low.f.modulo   2   task.modulo

   T.RATE TASK.period
   PRIME.TASKS
   TRIGGER.TASKS
;

: STOP.ACQ                                     \ stop acquisition
   STOP.TASKS
   CLEAR.TASKS
;

 REAL DIM[ 3000 ] ARRAY PIXBUF \ pixel buffer to allow fast graphic data
    erase
\ REAL DIM[ 6000 ] ARRAY PIXBUF \ pixel buffer to allow fast graphic
   data erase

\ token pixbuf
\ exp.mem> pixbuf
\ integer dim[ 10000 ] unnamed.array    becomes> pixbuf

: SET.GRAPHICS                \ setup the graphics scales
   0.025 .4  VUPORT.ORIG
   0.95  .45 VUPORT.SIZE       \ where to plot data

   .05 .05  AXIS.ORIG         \ center plotting area of vuport
   .9  .9   AXIS.SIZE
```

```
\   10   12  axis.divisions                                          211
   10   10  axis.divisions

   HORIZONTAL   NO.LABELS
   VERTICAL 0 1 LABEL.POINTS                \ plot vertical labels on
      even tick
                                                                    216
   NORMAL.COORDS .5 .5 AXIS.POINT           \ axis in center of vuport
\  0.80   0.1    position   " CHANNEL: "  p.chnl  get.chnl.str "cat
   label
   0.80   0.1    position   " CHANNEL: "  p.chnl  0 n>s  "cat label
   {29.line}  sc ."  RATE:"   4  0   fix.format    s.freq  n.type ."  Hz
      "
   previous.window                                                  221

   HORIZONTAL 0. p.points float WORLD.SET   \ set scales: indices on X
   VERTICAL   axis.fit.off

   VERTICAL   gra.lower.lim   gra.upper.lim   WORLD.SET   \ ... on Y   226
   OUTLINE
   XY.AXIS.PLOT                             \ axis and grid lines
   \  4096  ---  5V  ----  50cm
   \                      30     4096 * 0.8 = 3276.8
   \                                                                231
   \                     -30     4096 * 0.2 =  819.2
   \     0  --- -5V  ---- -50cm
   VERTICAL
       gain  2. /  vol.lower.lim -  dig.lim  *   gain /   neg  dig.lim +
       gain  2. /  vol.upper.lim -  dig.lim  *   gain /   neg  dig.lim +  236
\       dig.lim   gain  v.to.h *  2. /  gra.lower.lim +  gain v.to.h * /
     *  1 -
\       dig.lim   gain  v.to.h *  2. /  gra.upper.lim +  gain v.to.h * /
     *  1 -
   WORLD.SET   \ signal on Y
   14  color
   PIXBUF LINE.BUFFER.ON                                            241
;

19 5 23 75 WINDOW {PROMPT}                \ window for text prompts

: PROMPT'EM                               \ put up prompts           246
   GRAPHICS.DISPLAY
   SCREEN.CLEAR
   {PROMPT}
   CR  cr
   ."                  Type any <F> to stop monitoring" cr  cr        251
                \
   ."                  ----------  MONITORING"  ."  ----------"
   bell.2sl
;

integer scalar  dat.file.flag                                       256
0  dat.file.flag  :=
\ 1  dat.file.flag  :=
```



```
: PLOT.IT   \ loop to plot data,  synchronized to data acquisition
   BEGIN                                                            261
\      ERASE.LINES                  \ erase previous lines

       BEGIN                        \ wait for buffer to fill up
          ?BUFFER.SWITCH
            1  ?task.state  3  =  or                                266
       UNTIL
       ERASE.LINES                  \ erase previous lines

       ?BUFFER.A/B                  \ choose which buffer to plot
       IF   db1                                                     271
       ELSE db2
       THEN
       Y.DATA.PLOT                  \ plot new data

       1 ?task.state 3 = ?key if pckey drop                         276
                                 if  0  dat.file.flag :=   exit then
                              then  False or
    UNTIL
;                                                                   281
: CLEAN.UP                          \ clean up the system state when done
   LINE.BUFFER.OFF
   AXIS.DEFAULTS
   SCREEN.CLEAR \  b.t
   CR ." Done."                                                     286
   bell.2sl
;

: DOIT              \ overall functioning
   PROMPT'EM        \ write out prompts                             291
   SET.GRAPHICS     \ Set up graphics area and scaling
   START.ACQ        \ Start up the tasks
   PLOT.IT          \ Plot the data continuously
   STOP.ACQ         \ Stop tasks
 \ {29.line}                                                        296
 \ nd
 \ cr  " New Channel (9 --> Exit): "  s.type  1  n.type  #input s.chnls
    :=
 \ s.chnls  p.chnl :=
 \ cr  ." ok"
 \ s.chnls 1 - 0 swap  A/D.TEMPLATE CHNLs.IN      \ template for input   301
    on
 \ db3  db4  CYCLIC DOUBLE.TEMPLATE.BUFFERs
 \ p.chnl 1 - dup  A/D.TEMPLATE CHNL.plot         \ template for
    oscilloscope
 \ db1  db2  CYCLIC DOUBLE.TEMPLATE.BUFFERS
 \ myself
 \                                                                  306
   CLEAN.UP
;

\
```

```
   ------------------------------------------------------------------------
                                                                          311
0     1000 *   acq.del   :=
: acq.del.tes
\ b.t
cr ."          Press " b.t ." <F>" b.t ."       to set  Syncronized
   Acquisition !"
cr ."          Press " b.t ." <non-F>" b.t ."  to set  Delayed            316
   Acquisition !"
cr  cr cr  ."        "  .time
BELL.2sl
pckey not   drop
if
\ \ \    acq.del.def                                                      321
   SCREEN.CLEAR
   cr ."                 Delayed  Acquisition !  ---- " acq.del 1000 /
         .
   ."  Sec"
else
   SCREEN.CLEAR                                                          326
   cr ."                 Syncronized Acquisition !"
then
cr  cr cr  ."        "  .time

;                                                                        331

: acq.del.exe
acq.del  0  <>
if
acq.del  1000 /   tmp.v.i  :=                                           336
50 20 goto.xy   tmp.v.i      .        ."  Sec"
\ 1000  msec.delay
tmp.v.i  1 +   1
do
1000  msec.delay                                                        341
50 20 goto.xy   tmp.v.i  i -    .
loop
bell.2sl
then
bell.1sl                                                                346
;
\ b.t
\ \\ lower.wnd {border} screen.clear  acq.del.tes  cr  acq.del.exe

doit                                                                    351
\
   ------------------------------------------------------------------------


normal.display

\                                                                       356
   ========================================================================
```



```
: get.datafile.dat.p23
  10 17  goto.xy
  datafile.dat.p2   " .dat"   "cat   datafile.dat.p23  ":=
  ." The CASE name is       : "                                         361
  inv.on  datafile.dat  "type  inv.of
  cr
;
nd
\ get.datafile.dat.p23                                                  366

\ integer dim[ 6 ] array acq.input

\ load.overlay datafile.sov
regular.datafile                                                        371
file.template
   8 comments
   integer dim[ 6 ] subfile
end
: creat.datafile.dat.pass.to.b                                          376
  filepass.asy  defer> file.create
  filepass.asy  defer> file.open
  " Case          :   "  datafile.dat.p23 "cat mycase ":=  mycase     1 >
     comment
  " Date          :   "  "date            "cat mydate ":=  mydate     2 >
     comment
  " Time          :   "  "time            "cat mytime ":=  mytime     3 >  381
     comment
  " Specifics     :   "  specifics "cat  specifics ":=  specifics     4 >
     comment
                                              datafile.dat.p23     5 >
                                                 comment
  t.rate    acq.input  [ 1 ]  :=
  s.length  acq.input  [ 2 ]  :=
  s.freq    acq.input  [ 3 ]  :=                                        386
  s.chnls   acq.input  [ 4 ]  :=
  p.chnl    acq.input  [ 5 ]  :=
  p.points  acq.input  [ 6 ]  :=
  1 subfile  acq.input  array>file
  file.close                                                            391
  cr  ."       TMP data file created    :  "   filepass.asy     "type
     cr
;
\ creat.datafile.dat.pass.to.b

\                                                                       396
   ========================================================================

\
   !*************************************************************************


\
   ^*************************************************************************
```

```
  regular.datafile                                                        401
  file.template
    8 comments
    integer dim[ 6 ] subfile
\     integer dim[ s.length , s.chnls ] subfile
  end                                                                     406
: creat.datafile.dat
  datafile.dat  defer>  file.create
  datafile.dat  defer>  file.open
                                                  mycase          1
                                                     >comment
                                                  mydate          2   411
                                                     >comment
                                                  mytime          3
                                                     >comment
                                                  specifics       4
                                                     >comment
                                                  datafile.dat.p23 5
                                                     >comment
  1 subfile  acq.input  array>file
\  2 subfile  db0 array>file                                            416
  file.close
  cr  ."     ASYST data file created    :  " datafile.dat "type  cr
;
\ screen.clear
: dat.file                                                                421
  1  dat.file.flag   =
  if creat.datafile.dat
  then
;
\ dat.file                                                                426
\
   ============================================================================


lower.inner.wnd {border}

nd                                                                        431
color.on
my.def.colors
forget forget.word.acq
.time
bell.1LL                                                                  436
bell.2sl
```

CAL.men

A01812-20161220-A015 ❖ December 20, 2016 ❖ [Page count: 5]

```
\ ------ Asyst text file  EXP.DATA.CALIBRATION       (c) Lee Yueon-Ron
   ------- \

\  conv ell TS : 1.  Memory insen dir.lee. ta.file ered into
\                2.  Overlay files included
\                3.  System CONFIGURED properly
\                4.  Proper Device setting
\
\ KEY WORDS    : 1.  Background analog A/D
\                2.  Foreground multichannel simultaneous monitoring
\                3.  Multitasking operations with two cycle per min
   display
\                4.  With unit option
\                5.  Optimized concurrent acquisition for different
   channels
\
\ HINTS        : 1.  Array    ---  Minor
\                2.  Token    ---  No
\                3.  Unnamed  ---  Minor
\                4.  DAS buf  ---  Minor
\
\ Copyright          Oct, 1990  by Lee, (02/20/94)

\ normal.display screen.clear
echo.off

: forget.mark.cal ;

\ 1  2  16 78  window  cal.upper.wnd
2  3  19  76  window  cal.upper.wnd
186 205 201 200 188 187 border.chars

\ dir.lee.txt    " def-acqn.nam" defer> load
\ dir.lee.txt    " def-acqs.spe" defer> load

real
       scalar  dig.to.v
       scalar  offset

: def.values.cal
  gain  dig.lim /  dig.to.v   :=
  gain  v.to.h  * dig.lim /  dig.to.h   :=
  dig.lim  2. /   offset  :=
;
def.values.cal

 5  s.length  :=            \ 2 hz display
10  s.freq    :=
16  s.chnls   :=

1000 s.freq / t.rate :=
```



```
1 low.f.modulo   :=
: find.t.rate                \ for low frequency acq
  t.rate   53   >
  if
  t.rate       2 /      t.rate        :=
  low.f.modulo 2 *      low.f.modulo  :=
  t.rate   53   >
    if
      myself
    then
  then
;
find.t.rate

INTEGER DIM[ s.length , s.chnls ] arrAY db1
INTEGER DIM[ s.length , s.chnls ] ARRAY db2

s.chnls 1 - 0 swap  A/D.TEMPLATE CHNL.cal             \ template for
   cali
db1  db2  CYCLIC DOUBLE.TEMPLATE.BUFFERS

: START.ACQ                                          \ start acquisition
   CLEAR.TASKS

       chnl.cal a/d.init
       1 task a/d.in>array

       low.f.modulo   1   task.modulo

   T.RATE TASK.period
   PRIME.TASKS
   TRIGGER.TASKS
;

: STOP.ACQ                                           \ stop acquisition
   STOP.TASKS
   CLEAR.TASKS
;

integer  scalar  unit.opt
: screen.1
   SCREEN.CLEAR
   gd  hp nd
   cal.upper.wnd  {border}
   my.def.colors
   {border}
    "    Multichannel Digital Voltmeter" s.type.3    ."
        -------------------  "
   ."    Oct. 19 1990"  cr
   ."    "                  cr
   ."    "                  cr
   ."    Unit options  :              "          cr
   ."                         1.  cm "          cr
   ."                         2.  volt"         cr
   ."                         3.  original"     cr
```

```
   ."                    "                    cr
   ."    Please select :    " \ #input  unit.opt  :=
   1  0  fix.format         2   get.val  unit.opt  :=
   9  4  fix.format                                          106
   4  15 goto.xy
   ."    Reenter:"          " <F>"       s.type.3
   ."    Continue:"         " <non-F>"   s.type.3

 \  cr cr cr                                                 111
 \  ."    Press <non-F> key to start gauge Calibration !"  cr
 \  ."    Press <F>     key to rechoose option !"
   bell.2SL
   pckey  if drop  myself then drop
;                                                           116

\ : unit.conv
\    unit.opt  1  =
\    if  offset -    dig.to.h  *    conv  :=  \ --- CM
\    else unit.opt  2  =                                    121
\         if  offset -  dig.to.v *     conv  :=  \ ---  VOLT
\         else   1.   conv  :=  \  ---  ORIGINAL
\         then
\    then
\ ;                                                         126

real scalar  dig.con
: tmp.word
   unit.opt  1  =
   if  offset  offset  :=                                   131
       dig.to.h  dig.con  :=  \ --- CM
   else unit.opt  2  =
        if  offset  offset  :=
            dig.to.v  dig.con  :=   \ ---  VOLT
        else   0.  offset  :=                               136
               1.  dig.con  :=    \  ---  ORIGINAL
        then
   then
;
: conv                                                      141
  offset -    dig.con *
;

9 4 fix.format
: fixed.screen                                              146
   SCREEN.CLEAR
   ."    Type any  <F>  to stop gauge CALIBRATION"
   unit.opt  1  =
   ."            Unit :  "
   color.on  1  background  14 foreground                   151
   if   ."   CM  "
   else unit.opt  2  =
        if    ."  VOLT "
        else     ."  ORIGINAL "
        then                                                156
   then
```



```
\ 1  background  12 foreground
12 4  goto.xy   " Channel No /   value             Channel No /   value"
   s.type.3
1  background  12 foreground
12 6  goto.xy  ."          1                                 9 "      161
12 7  goto.xy  ."          2                                10 "
12 8  goto.xy  ."          3                                11 "
12 9  goto.xy  ."          4                                12 "
12 10 goto.xy  ."          5                                13 "
12 11 goto.xy  ."          6                                14 "      166
12 12 goto.xy  ."          7                                15 "
12 13 goto.xy  ."          8                                16 "
color.off
cr  ."  "  cr
."                                              Y.R. Lee / "  .time  171
;

: cal.IT   \ loop to plot data,  synchronized to data acquisition
   BEGIN
      \ = ERASE.LINES                  \ erase previous lines   176

      BEGIN                          \ wait for buffer to fill up
         ?BUFFER.SWITCH
          1  ?task.state  3  =  or
      UNTIL                                                    181

      ?BUFFER.A/B                    \ choose which buffer to plot
      if
        8  0  do
                23   i 6 +  goto.xy    db1   [ 1 , i 1 + ] conv  .   186
                55   i 6 +  goto.xy    db1   [ 1 , i 9 + ] conv  .
              loop
               \ 66 15 goto.xy .time
      ELSE
        8  0  do                                               191
                23   i 6 +  goto.xy    db2   [ 1 , i 1 + ] conv  .
                55   i 6 +  goto.xy    db2   [ 1 , i 9 + ] conv  .
              loop
              \ 66 15 goto.xy .time
        THEN                                                   196

      1 ?task.state 3 = ?key if pckey drop
                                if exit then
                             then  False or
    UNTIL                                                      201
;

: CLEAN.UP                         \ clean up the system state when done
   LINE.BUFFER.OFF
   AXIS.DEFAULTS                                               206
   SCREEN.CLEAR b.t
   CR ." Data acquisition finished"
   BELL.2sl
;
   screen.clear cal.upper.wnd  {border}                        211
```

```
   screen.1 {border}
   tmp.word {border}

: doIT               \ overall functioning
   \ = PROMPT'EM         \ write out prompts                          216
   \ = SET.GRAPHICS      \ Set up graphics area and scaling
   START.ACQ          \ Start up the tasks
   fixed.screen
   cal.IT            \ Plot the data continuously
   STOP.ACQ           \ Stop tasks                                    221
   \ = CLEAN.UP
;

doit
color.on                                                            226
my.def.colors
\ ================================================================

lower.inner.wnd {border}
bell.1LL                                                            231
normal.display
forget forget.mark.cal
\ ================================================================
```

LAcq-Spe.men

A01813-20161220-A016 ❖ December 20, 2016 ❖ [Page count: 12]

```
\ ------------------------------ Lee.men                                    1
   ----------------------------------
\ 02/20/94
\ ------------------------------------------------------------------
\ ---  Asyst Menu for real time experiments sys clear  (c) Lee, Yueon-
   Ron -- \
\
\ Requirements :  1.  Memory allocation sensitive                         6
\                 2.  Overlay files included
\                 3.  Confirm device parameters
\                 4.  Configure system properly
\                 5.  Follow subprogram restrictions
\                                                                        11
\ Keywords     :  1.  Acquisition plus analysis
\                 2.  Acquisition
\                 3.  Analysis
\                 4.  Calibration
\                 5.  Scrolling of data                                  16
\                 6.  Real time foreground and background multitasking
   system
\
\ Copyright    :      By Lee,  Oct, 1990.

echo.off                                                                 21
: lacq-spe ;
sc  ."   --  Y.R. Lee --    "   .date   ." ---------   "    .time
1  29.flag :=   {29.line}
0  bell.flag :=
1  menu.flag  :=                                                        26
" y"  my.pause.flag ":=
  forget.all
  my.def.colors
\  dir.lee.txt  " bell.txt"      "cat   defer> load
  dir.lee.txt  " def-winn.nam"  "cat   defer> load                       31
  dir.lee.txt  " def-acqn.nam"  "cat   defer> load
  \ nd
  dir.lee.txt  " def-acqs.spe"  "cat   defer> load
  dir.lee.txt  " def-anan.nam"  "cat   defer> load
  \ dir.lee.txt  " def-ana1.1sp"  "cat   defer> load                     36
\ dir.lee.txt  " def-ana9.9sp"  "cat   defer> load  \ for recover.par
\ dir.lee.txt  " def-ana1.1s2"  "cat   defer> load  \ for recover.par
  dir.lee.txt  " def-ana1.1sp"  "cat   defer> load  \ for recover.par

  dir.lee.txt  " lspe-acq.dat"  "cat                                    41
  get.par.file
  recover.par.acq

echo.off
stack.reset                                                              46
\ 7 set.file.parse
\ def.vuport line.edit
integer scalar row.beg
```



```
1  row.beg  :=
\ ------------------------ Words for resetting parameter                 51
   --------------------
\ ------------------------------------------------------------------
: reset.par.str
   \  Numbeer specifications
   \         " 1234567890123"
   1         " Samp Rate    ="     #spe.str "[   ]  ":=                 56
   2         " Samp Duratio="      #spe.str "[   ]  ":=
   3         " Chan begin   ="     #spe.str "[   ]  ":=
   4         " Chan end     ="     #spe.str "[   ]  ":=
   5         " Monitored Ch="      #spe.str "[   ]  ":=
   6         " Delay Time 1="      #spe.str "[   ]  ":=                 61
   7         " Delay Time 2="      #spe.str "[   ]  ":=
   8         " Delay Time 3="      #spe.str "[   ]  ":=
   9         " Delay Time 4="      #spe.str "[   ]  ":=
   10        " V.to.H       ="     #spe.str "[   ]  ":=
   11        " Upper H Limi="      #spe.str "[   ]  ":=                 66
   12        " Lower H Limi="      #spe.str "[   ]  ":=
   13        " del.str.pos ="      #spe.str "[   ]  ":=
\  14        " Chan start #="      #spe.str "[   ]  ":=
\  11        " #.group      ="     #spe.str "[   ]  ":=
\  12        " group.ele.1 ="      #spe.str "[   ]  ":=                 71
\  13        " group.ele.2 ="      #spe.str "[   ]  ":=
\  14        " Add Chnl     ="     #spe.str "[   ]  ":=
\  15        " Reserved      "     #spe.str "[   ]  ":=
   \  String specifications
   1         " Delay Str 1 ="      "spe.str "[   ]  ":=                 76
   2         " Delay Str 2 ="      "spe.str "[   ]  ":=
   3         " Delay Str 3 ="      "spe.str "[   ]  ":=
   4         " Delay Str 4 ="      "spe.str "[   ]  ":=
   5         " Check file  ="      "spe.str "[   ]  ":=
   6         " DMA Align   ="      "spe.str "[   ]  ":=                 81
   7         " DMA or Sync ="      "spe.str "[   ]  ":=
\  9         "null                 "spe.str "[   ]  ":=
\  10        "null                 "spe.str "[   ]  ":=
;
                                                                         86
: reset.par.str.0
   \  Numbeer specifications
   \         " 1234567890123"
   1         " r.Station.1 ="      #spe.str "[   ]  ":=
   2         " r.Spacing.1 ="      #spe.str "[   ]  ":=                 91
   3         " r.Depth.1   ="      #spe.str "[   ]  ":=
   4         " r.Beg.pnt.1 ="      #spe.str "[   ]  ":=
   5         " r.Station.2 ="      #spe.str "[   ]  ":=
   6         " r.Spacing.2 ="      #spe.str "[   ]  ":=
   7         " r.Depth.2   ="      #spe.str "[   ]  ":=                 96
   8         " r.beg.pnt.2 ="      #spe.str "[   ]  ":=
   9         " r.fft points="      #spe.str "[   ]  ":=
   10        " PS.#.fft.pts="      #spe.str "[   ]  ":=
   11        " #.group      ="     #spe.str "[   ]  ":=
   12        " group.ele.1 ="      #spe.str "[   ]  ":=                 101
   13        " group.ele.2 ="      #spe.str "[   ]  ":=
   14        " Add Chnl     ="     #spe.str "[   ]  ":=
```

```
   15        " Reserved      "      #spe.str "[   ]   ":=
   \  String specifications
   1         " xy.axis(l/o)="       "spe.str "[   ]   ":=
   2         " wnd.str      ="      "spe.str "[   ]   ":=
   3         " offset (y/n)="       "spe.str "[   ]   ":=
   4         " y.lab  (n/e)="       "spe.str "[   ]   ":=
   5         " H.copy (y/n)="       "spe.str "[   ]   ":=
   6         " Make ASCII   ="      "spe.str "[   ]   ":=
   7         " View data    ="      "spe.str "[   ]   ":=
   8         " Print OnSite="       "spe.str "[   ]   ":=
   9         "null                  "spe.str "[   ]   ":=
   10        "null                  "spe.str "[   ]   ":=
;

: c>"a   \  [ "ele , array ]
  \  1  #spe.str "[ ]  ":=
  "[ ]  ":=
;
: "a>c     \  [ ele.# , "array , offset ]  "array>comment
  \ function    \  #spe.str "[  1 ]                1 >comment
                \  1  #spe.str "[ ]  ":=
  swap
  dup
  "[ ]
  +
  >comment
;
: create.ini.par.file
  regular.datafile
  file.template
    60 comments
    real dim[ #.#spe ] subfile
  end
  \  dir.lee.txt  " lspe-acq.dat" "cat  defer>  file.create
  \  dir.lee.txt  " lspe-acq.dat" "cat  defer>  file.open
    spe.str                          defer>  file.create
    spe.str                          defer>  file.open
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  #spe.str  0  "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe.str  20 "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe      40 "a>c
      tmp.v.i  #.#spe  =
    until
```



```
  1 subfile  #spe    array>file
  file.close
;
dir.lee.txt  " lspe-acq.dat" "cat  \ spe.str
get.par.file  my.pause
reset.par.str          \ needed when first change
create.ini.par.file    \ needed when first change
\ ------------------------------------------------------------------
\ ------------------------------------ Colon Defs FOR MENU
   --------------------
integer  scalar  ana.flag
: run.acq
  dir.lee.txt     " acq.men"     "cat defer> load
  stack.clear
;
: run.a+a
  nd
  2 0 fix.format
  "  Use ANA menu (1, 2, 3, ..., 9:all) when analyzed? "
  s.type   2  get.val  ana.flag :=
  {29.line}

  \  dir.lee.txt     " acq.men"     "cat defer> load

  " y"  non.stop.str  ":=
  ana.flag
  case
    1  of  dir.lee.txt     " lsta-0.txt"     "cat defer> load   endof
    2  of  dir.lee.txt     " lref-0.txt"     "cat defer> load   endof
    9  of  dir.lee.txt     " lsta-0.txt"     "cat defer> load
           dir.lee.txt     " lref-0.txt"     "cat defer> load   endof
  endcase
  " n" non.stop.str  ":=
  stack.clear
;
: run.ref
  {29.line}
  dir.lee.txt     " lref-0.txt"     "cat defer> load
  nd
  stack.clear
;
: run.sta
  {29.line}
  " n"  non.stop.str  ":=
  dir.lee.txt     " lsta-0.txt"     "cat defer> load
  stack.clear
;
: run.whp
  {29.line}
  dir.lee.txt     " lwhp-0.txt"     "cat defer> load
  nd
  stack.clear
;
: run.scr
  {29.line}
```

```
  dir.lee.txt      " scr.men"      "cat defer> load
  stack.clear
;
: run.mon                                                              216
  {29.line}
  dir.lee.txt      " mon.men"      "cat defer> load
  stack.clear
;
: run.cal                                                              221
  {29.line}
  dir.lee.txt      " cal.men"      "cat defer> load
  cr .time
  stack.clear
;                                                                      226
\ ^--------------------------------------------------------------------^
: sta.hlp
  dir.lee.txt   " lsta.hlp"  "cat  defer> load
;
: ref.hlp                                                              231
  dir.lee.txt   " lref.hlp"  "cat  defer> load
;
: kr.hlp
  dir.lee.txt   " lref.hlp"  "cat  defer> load
;                                                                      236
: par.hlp
  dir.lee.txt   " lpar.hlp"  "cat  defer> load
;
: let.hlp
  dir.lee.txt   " llet.hlp"  "cat  defer> load                         241
;
: cal.hlp
  dir.lee.txt   " lcal.hlp"  "cat  defer> load
;
: acq.hlp                                                              246
  dir.lee.txt   " lacq.hlp"  "cat  defer> load
;
: a&a.hlp
  dir.lee.txt   " LAnA.hlp"  "cat  defer> load
;                                                                      251
: mon.hlp
  dir.lee.txt   " lmon.hlp"  "cat  defer> load
;

\ ----------------------- Words for resetting parameter                256
   --------------------
: get.#spe.ini
  10  3 fix.format
  0  tmp.v.i  :=
  begin
    tmp.v.i  1 +   tmp.v.i :=                                          261
    tmp.v.i  col.1.pos  col.1.w 1 + + over  row.beg +  goto.xy #spe swap
        [ ] .
    #spe.str  "[ tmp.v.i 1 + ]  "null   "=
  until
  \  21  3  goto.xy  #spe [ 1 ]  .
```



```
;                                                                      266
: get."spe.ini
  0  tmp.v.i  :=
  begin
    tmp.v.i  1 +   tmp.v.i :=
    tmp.v.i  col.2.pos  col.2.w 1 + + over row.beg + goto.xy "spe "[ ]   271
       "type
    "spe.str "[ tmp.v.i 1 + ]  "null  "=
  until
;
: get."spe.p1   \  [ ele.# - ]
  10  foreground                                                       276
  10 3 fix.format
  tmp.v.i.2  :=
  tmp.v.i.2
  16  col.2.pos +  tmp.v.i.2 row.beg +  goto.xy  "spe "[ tmp.v.i.2 ]
     get.str
                                                 "spe "[ tmp.v.i.2 ] ":= 281
  my.def.colors
;
: get.#spe.p1   \  [ ele.# - ]
  10  foreground
  10 3 fix.format                                                      286
  tmp.v.i.2  :=
  tmp.v.i.2
\ 28  tmp.v.i.2 row.beg +  goto.xy  #spe [ tmp.v.i.2 ] get.val
\                                   #spe [ tmp.v.i.2 ] :=
  28  tmp.v.i.2 row.beg +  goto.xy                                     291
  tmp.v.i.2  1  =  if  32000  #spe [ 2 ] /   #spe [ 3 ] /          then
  tmp.v.i.2  2  =  if  32000  #spe [ 1 ] /   #spe [ 3 ] /          then
  tmp.v.i.2  3  =  if  32000  #spe [ 1 ] /   #spe [ 2 ] /  trunc   then
  tmp.v.i.2  4  >= if  32000  #spe [   tmp.v.i.2        ]          then
     get.val                  #spe [ tmp.v.i.2 ] :=                  296
                              my.def.colors
;
: get.#spe.1     1  get.#spe.p1  ;
: get.#spe.2     2  get.#spe.p1  ;
: get.#spe.3     3  get.#spe.p1  ;                                     301
: get.#spe.4     4  get.#spe.p1  ;
: get.#spe.5     5  get.#spe.p1  ;
: get.#spe.6     6  get.#spe.p1  ;
: get.#spe.7     7  get.#spe.p1  ;
: get.#spe.8     8  get.#spe.p1  ;                                     306
: get.#spe.9     9  get.#spe.p1  ;
: get.#spe.10    10 get.#spe.p1  ;
: get.#spe.11    11 get.#spe.p1  ;
: get.#spe.12    12 get.#spe.p1  ;
: get.#spe.13    13 get.#spe.p1  ;                                     311
: get.#spe.14    14 get.#spe.p1  ;
: get.#spe.15    15 get.#spe.p1  ;

: get."spe.1     1  get."spe.p1  ;
: get."spe.2     2  get."spe.p1  ;                                     316
: get."spe.3     3  get."spe.p1  ;
: get."spe.4     4  get."spe.p1  ;
```

```
: get."spe.5      5  get."spe.p1  ;
: get."spe.6      6  get."spe.p1  ;
: get."spe.7      7  get."spe.p1  ;
: get."spe.8      8  get."spe.p1  ;
: get."spe.9      9  get."spe.p1  ;
: get."spe.10     10 get."spe.p1  ;
: get."spe.11     11 get."spe.p1  ;

\ ================================================================
: create.lspe.dat
  regular.datafile
  file.template
    60 comments
    real dim[ #.#spe ] subfile
  end
  spe.str                          defer>  file.create
  spe.str                          defer>  file.open
\  dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.create
\  dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.open
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  #spe.str  0  "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe.str  20 "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe      40 "a>c
      tmp.v.i  #.#spe  =
    until
  1 subfile  #spe    array>file
  file.close
;
: done
    create.lspe.dat
    \    #.#spe 2 + 1 +    col.1.pos  7 + goto.xy
    \    ."   lspe-ana data file created : "
    \ ."  OK?"  spe.str       get.str   spe.str  ":=
    spe.str       get.str   spe.str  ":=
    stack.clear
;
\ ------------------------- Declaration of Menus
   ------------------------------!
Menu main.Menu
\ ------------------------- Declaration of Menus
   ------------------------------!
Menu par.menu
Menu hlp.Menu
```



```
Menu acq.Menu
Menu ana.Menu
Menu a+a.Menu
Menu cal.Menu
Menu scr.Menu

\ ------------------------- Declaration of Vuports
   ----------------------------!
Vuport Bottom
\ ------------------------- MENU STATUS WORDS
   --------------------------------!
: main.status             \ For menu.status on Main.menu
    0  background
    3  foreground
    2  11 goto.xy ." Press"  b.t  ."  <F10> "  b.t  ." for help"
    2  12 goto.xy ." Press"  b.t  ."  ARROW "  b.t  ." key to choose an
       item"
    2  13 goto.xy ." Press"  b.t  ."   ESC  "  b.t  ." key to  exit any
       menu"
    43 12 goto.xy ."          " ." Log in Time : "  .time
    43 13 goto.xy ."          "  " Y.R. Lee"  s.type ."  / 1990, 94, 96"
\   55 11 goto.xy ." Y.R. Lee / Oct. 22 1990"
\   43 11 goto.xy " Developed : Y.R. Lee"  s.type ."  / Oct. 22 1990"
    0  background         \ menu.color
    10 foreground
;
: par.status              \ For menu.status on Main.menu
    1  background
    3  foreground
    get.#spe.ini
    get."spe.ini
    \  #.#spe row.beg + 2 -
    col.1.pos  7 +     #.#spe  row.beg + 2 -    goto.xy
    \    ."   lspe-ana data file created : "
    \  " Resetting  " dir.lee.txt " lspe-ana.dat" "cat  "cat  "type
    spe.str                                              "type
    2  19 goto.xy ." Press"  b.t  ."  <F10> "  b.t  ." for help"
    2  20 goto.xy ." Press"  b.t  ."  ARROW "  b.t  ." key to choose an
       item"
    2  21 goto.xy ." Press"  b.t  ."   ESC  "  b.t  ." key to  exit any
       menu"
    43 21 goto.xy ."          " " Y.R. Lee"  s.type ."  / 1990, 94"
    1  background
    13 foreground
;
: hlp.status
    5   background
    3   foreground
    1 0 goto.xy   ." <Enter> key to choose an item"
    1 1 goto.xy   ." <Esc> key to escape current menu"
    1 2 goto.xy   ." Choose an item: "
    5   background
    0   foreground
;
\
```

```
    ------------------------------------------------------------------------------

par.menu                                                                        421
    Menu.Store.Disk
    Menu.status par.status
    " Reset Parameters ---  " "date  "cat    MENU.TITLE
    \    Menu.Pull.Down
    Menu.blow.up                                                                426
    1 1 23 79                                   MENU.SHAPE
    1  13                                       MENU.COLOR
    14                                          Menu.Prompt.Color
    \ 4                                           Menu.Prompt.Color
    1  row.beg + col.1.pos  #spe.str  "[  1 ]   MENU.ITEM{ get.#spe.1  }       431
    2  row.beg + col.1.pos  #spe.str  "[  2 ]   MENU.ITEM{ get.#spe.2  }
    3  row.beg + col.1.pos  #spe.str  "[  3 ]   MENU.ITEM{ get.#spe.3  }
    4  row.beg + col.1.pos  #spe.str  "[  4 ]   MENU.ITEM{ get.#spe.4  }
    5  row.beg + col.1.pos  #spe.str  "[  5 ]   MENU.ITEM{ get.#spe.5  }
    6  row.beg + col.1.pos  #spe.str  "[  6 ]   MENU.ITEM{ get.#spe.6  }       436
    7  row.beg + col.1.pos  #spe.str  "[  7 ]   MENU.ITEM{ get.#spe.7  }
    8  row.beg + col.1.pos  #spe.str  "[  8 ]   MENU.ITEM{ get.#spe.8  }
    9  row.beg + col.1.pos  #spe.str  "[  9 ]   MENU.ITEM{ get.#spe.9  }
    10 row.beg + col.1.pos  #spe.str  "[ 10 ]   MENU.ITEM{ get.#spe.10 }
    11 row.beg + col.1.pos  #spe.str  "[ 11 ]   MENU.ITEM{ get.#spe.11 }       441
    12 row.beg + col.1.pos  #spe.str  "[ 12 ]   MENU.ITEM{ get.#spe.12 }
    13 row.beg + col.1.pos  #spe.str  "[ 13 ]   MENU.ITEM{ get.#spe.13 }
\     14 row.beg + col.1.pos  #spe.str  "[ 14 ]   MENU.ITEM{ get.#spe.14
    }
\    15 row.beg + col.1.pos  #spe.str  "[ 15 ]   MENU.ITEM{ get.#spe.15 }
                                                                              446
    1  row.beg + col.2.pos  "spe.str  "[  1 ]   MENU.ITEM{ get."spe.1  }
    2  row.beg + col.2.pos  "spe.str  "[  2 ]   MENU.ITEM{ get."spe.2  }
    3  row.beg + col.2.pos  "spe.str  "[  3 ]   MENU.ITEM{ get."spe.3  }
    4  row.beg + col.2.pos  "spe.str  "[  4 ]   MENU.ITEM{ get."spe.4  }
    5  row.beg + col.2.pos  "spe.str  "[  5 ]   MENU.ITEM{ get."spe.5  }       451
    6  row.beg + col.2.pos  "spe.str  "[  6 ]   MENU.ITEM{ get."spe.6  }
    7  row.beg + col.2.pos  "spe.str  "[  7 ]   MENU.ITEM{ get."spe.7  }
\     8  row.beg + col.2.pos  "spe.str  "[  8 ]   MENU.ITEM{ get."spe.8
    }
\    9  row.beg + col.2.pos  "spe.str  "[  9 ]   MENU.ITEM{ get."spe.9  }
\    10 row.beg + col.2.pos  "spe.str  "[ 10 ]   MENU.ITEM{ get."spe.10 }       456

\    #.#spe row.beg + 1 +    col.1.pos  3 -  " Done?"   menu.item{ done }
    #.#spe row.beg + 2 -    col.1.pos  3 -  " Done?"   menu.item{ done }
\           row.beg   1 -    col.1.pos  3 -  " Done?"   menu.item{ done }
                                                                              461
MENU.END

: ana.status             \ For menu.status on Main.menu
    0   background
    3   foreground                                                              466
    1  10 goto.xy ." Press" b.t ."  F10 " b.t ." for help"
    3   background
    4   foreground
;
                                                                              471
```



```
\ ------------------------------- MENUS
    ---------------------------------------!
ana.MENU
    Menu.Store.Disk

    \    " ANALYSIS MENU"                                  Menu.Title        476
    "  ANA "                                Menu.Title
    menu.status ana.status
    \ Menu.Pop.UP
    Menu.blow.UP
    7  16  16  46                                          Menu.Shape        481
    3  4                                                   Menu.Color
    14                                                     Menu.Prompt.Color
\   1 1 " Spectra & Statisitcs"                            Menu.Item{ run.sta }
\   2 1 " Wave Form Analysis (Kr)"                         Menu.Item{ run.ref }
\   3 1 " Distibution Curves"                              Menu.Item{ run.whp }  486
    4 1 " == Reset ACQ Parameters =="                      Menu.Item{ par.menu }
\   5 1 " [Wavelet Analysis]"                              Menu.Item{ nop     }
\   6 1 " [Wavelet & Spectral Coherence]"                  Menu.Item{ nop     }
    \ Make prompt color same as foreground because no items are chosen
      here
MENU.END                                                                      491

\ ------------------------- Designing The Main Menu
    ---------------------------!
main.menu
    Menu.Store.Disk
    \ Menu.Store.memory                                                       496
    Menu.status main.status
    " REAL TIME SYSTEM   ---  " "date  "cat    MENU.TITLE
    Menu.Pull.Down
    1 1 14 79                                          MENU.SHAPE
    0  10                                              MENU.COLOR             501
    14                                                 Menu.Prompt.Color
\   3  3  " ---ACQ---"                                 MENU.ITEM{ run.acq }
\   3  19 " ---A+A---"                                 MENU.ITEM{ ana.menu }
    3  19 " --- reset ACQ parameters ---"              MENU.ITEM{ par.menu }
\   3  35 " -ACQ+ANA-"                                 MENU.ITEM{ run.a+a }   506
\   3  50 " ---CAL---"                                 MENU.ITEM{ run.cal }
\   3  65 " ---MON---"                                 MENU.ITEM{ run.mon }
MENU.END

Hlp.MENU                                                                      511
    " HELP"                                        Menu.Title
    Menu.status hlp.status
    Menu.Pop.UP
\   10 43 22 78                                    Menu.Shape
    10  3 22 39                                    Menu.Shape                 516
    5  0                                           Menu.color
    14                                             Menu.Prompt.Color
\   0 1 " <Enter> key to choose an item"           Menu.Item{ NOP }
\   1 1 " <Esc> key to escape current menu"        Menu.Item{ NOP }
\   2 1 " Choose an item: "                        Menu.Item{ NOP }           521
    3 3 " -- ACQ --"                               Menu.Item{ acq.hlp }
    4 3 " -- ANA & A+A --"                         Menu.Item{ a&a.hlp }
```

```
    5 6 " Spectra & Statisitcs"                  Menu.Item{ sta.hlp }
    6 6 " Wave Form Analysis"                    Menu.Item{ ref.hlp }
    7 6 " Kr computation"                        Menu.Item{ kr.hlp  }
    8 6 " == Reset Parameters =="                Menu.Item{ par.hlp }
    9 6 " [Wavelet Analysis]"                    Menu.Item{ let.hlp }
   10 6 " [Wavelet & Spectral Coherence]"        Menu.Item{ let.hlp }
   11 3 " -- CAL --"                             Menu.Item{ cal.hlp }
   12 3 " -- MON --"                             Menu.Item{ mon.hlp }
    0 foreground
\   \ Make prompt color same as foreground because no items are chosen
   here
MENU.END

\ ------------- Assigning Menus & Colon Defs To Function Keys
   -----------------!
    F5   Menu.key.does run.mon
    F4   Menu.key.does run.cal
    F3   Menu.key.does run.a+a
    F2   Menu.key.does run.sta
    F1   Menu.key.does run.acq
    F10  Menu.key.does hlp.menu

\ -------------------- Initializing and starting program
   ----------------------!
: Start
    echo.off
    Stack.clear
    \ Menu.stack.clear            \ Clears all active menus
    Normal.display
    main.menu
    bell.1LL
    menu.execute
    \    0 menu.flag :=  \ restore
    \    Normal.display
;
bell.1ll
start
17 1 +  #.#spe :=
real dim[ #.#spe ] array #spe
: create.comment
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  #spe.str  0  "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
      tmp.v.i  "spe.str  20 "a>c
      tmp.v.i  #.#spe  =
    until
    0  tmp.v.i  :=
    begin
      tmp.v.i 1 +  tmp.v.i  :=
```



```
      tmp.v.i  "spe       40 "a>c
      tmp.v.i  #.#spe  =
    until
;
: create.blank.file
  regular.datafile
  file.template
    60 comments
    real dim[ #.#spe ] subfile
  end
\ dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.create
\ dir.lee.txt  " lspe-ana.dat" "cat  defer>  file.open
\  dir.lee.txt  " lspe-acq.dat" "cat  defer>  file.create
\  dir.lee.txt  " lspe-acq.dat" "cat  defer>  file.open
  tmp.s.2  defer>  file.create
  tmp.s.2  defer>  file.open
  1 subfile  #spe    array>file
  file.close
;
\ create.blank.file
```

LSTA.HLP

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```
{29.line}                                                                    1
: tmp
\ cr ." : lsta-0 ;"    cr  nd
nd
."  ================================================================="
cr ."  \"                                                               6
cr ."  \ Keywords       :  1. Create ASCII data files w or w/o unit
    conversion"
cr ."  \                   2. Data statistics"
cr ."  \                   3. Autocorrelation"
cr ."  \                   4. Power spectra"
cr ."  \                   5. Hilbert transform"                        11
cr ."  \                   7. Wavelet transform"
cr ."  \                   8. Significant level"
cr ."  \                   9. File to array  &  Array to file"
cr
cr ."  \ Written        :  " " Nov. 1993 by  Y-R Lee" s.type             16
cr
."  ================================================================="
;
tmp
 {29.line}                                                                  21
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause
 tmp.s  my.pause.flag   ":=                                                 26
 forget tmp
 stack.clear
```

LPlt.hlp


```
{29.line}                                                                       1
: tmp
\ cr ." : lplt-0 ;"    cr  nd
nd
."  ================================================================="
cr ."  \"                                                                      6
cr ."  \ Keywords       :  1. A very flexible Stripe Chart generator"
cr ."  \                   2. Optimized for printer output"
cr ."  \                   3. User selectable Ranges in both X and Y"
cr ."  \                   4. Fully legended"
cr ."  \                   5. Single or two Plots"                             11
cr
cr ."  \ Written        :  " " Nov. 1993 by  Y-R Lee" s.type
cr
."  ================================================================="
;                                                                               16
tmp
 {29.line}
 my.pause.flag  tmp.s  ":=
 " y"  my.pause.flag   ":=
 bell.1sl                                                                       21
 my.pause
 tmp.s  my.pause.flag  ":=
 forget tmp
 stack.clear
```

LSCR.HLP

A01816-20161220-A019 ❖ December 20, 2016 ❖ [Page count: 1]

```
{29.line}                                                                    1
: tmp
\ cr ." : lplt-0 ;"   cr  nd
nd
."  ================================================================="
cr ."  \"                                                               6
cr ."  \ Keywords       :  1. Precise PC screen display of data scrolling
   "
cr ."  \                   2. Optimized for 640*480 pixel screen"
cr ."  \                   3. Auto Ranges in both X and Y"
cr ."  \                   4. Fully legended"
cr ."  \                   5. Show any channel you like"                   11
cr
cr ."  \ Written        :  " " Nov. 1993 by  Y-R Lee" s.type
cr
."  ================================================================="
;                                                                           16
tmp
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl                                                                   21
 my.pause
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear
```

```
      02/94)"
  s.type
  cr
  cr ." \                                                                    46
     ================================================================
     "
;
tmp
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=                                                 51
 bell.1sl
 my.pause
 tmp.s  my.pause.flag   ":=
\ forget tmp
\ stack.clear                                                               56

tmp.2
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=                                                 61
 bell.1sl
 my.pause
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear                                                                66
```

LRef.hlp

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```
{29.line}                                                                   1
: tmp
\  nd  ." lref"  cr
  nd
  cr ." \
     ================================================================"
  cr                                                                        6
  cr ." \ REQUIREMENTS : 1.  LIM EMM4"
  cr ." \                2.  Overlay files included ( Data, Wave, Alg )"
  cr ." \                3.  Compatible raw data file structure ( ACQ )"
  cr ." \                4.  Consistant Jumper or Gain setting
     parameters"
  cr ." \                5.  Maximum number of waves for each channel       11
     not to overflow"
  cr ." \                6.  System configured properly"
  cr ." \"
  cr ." \ KEY WORDS    : 1.  Raw data manipulation and analysis"
  cr ." \                2.  Wave statistics"
  cr ." \                3.  Convolution low pass filtering"               16
  cr ." \                4.  Fast Fourier transform"
  cr ." \                5.  Regular wave reflection coefficient"
  cr ." \                6.  Irregular wave reflection coefficient"
  cr ." \                7.  Reconstructed incident and reflection waves
     "
  cr ." \                8.  Modulated structure"                           21
  cr ." \ WRITTEN    --    " " Dec, 1990 by  Lee Yueon-Ron  (03/91, 11/93,
      02/94)"
  s.type
  cr
  cr
  cr ." More..."                                                            26
;

: tmp.2
  nd
  cr                                                                        31
  cr ." \ MEM HINTS     :"
  cr ." \        1.  Array      --- minor"
  cr ." \              old ver --- DAS        +  minor"
  cr ." \                        1C *8 *2"
  cr ." \        2.  Token      --- minor"                                 36
  cr ." \              old ver --- 1 cha +  FFT coef  + IFFT  +  w.h
     +  w.p"
  cr ." \                          1C *4   1C *2*2 *4   2C *8  1000 *4
     1000 *4"
  cr ." \        3.  Unnamed    --- [FFT]      +   Re[FFT]   ( > Ramp for
     PSD )"
  cr ." \                          1C *1*2*4    1C *1*1*4       1 ch *2*4
     "
  cr ." \        4.  DAS buf    --- 0"                                     41
  cr ." \"
  cr ." \ WRITTEN    --    " " Dec, 1990 by  Lee Yueon-Ron  (03/91, 11/93,
```

LWHP.HLP

A01819-20161220-A022 ❖December 20, 2016❖ [Page count: 2]

```
{29.line}                                                                  1
: tmp
\  nd  ." lwhp"  cr
  nd
  cr ." \
     ================================================================="
  cr                                                                       6
  cr ." \ REQUIREMENTS : 1.  LIM EMM4"
  cr ." \                2.  Overlay files included ( Data, Wave, Alg )"
  cr ." \                3.  Compatible raw data file structure ( ACQ )"
  cr ." \                4.  Consistant Jumper or Gain setting
     parameters"
  cr ." \                5.  Maximum number of waves for each channel     11
     not to overflow"
  cr ." \                6.  System configured properly"
  cr ." \"
  cr ." \ KEY WORDS    : 1.  Raw data manipulation and analysis"
  cr ." \                2.  Wave statistics"
  cr ." \                3.  Convolution low pass filtering"              16
  cr ." \                4.  Cummulated distribution curves of wave"
  cr ." \                5.  Wave height or wave period -- optional"
  cr ." \ WRITTEN    --    " " Dec, 1994 by  Lee Yueon-Ron  (03/91, 11/93,
      02/94)"
  s.type
  cr                                                                       21
  cr
  cr ." \
     ================================================================="
\ cr ." More..."
;
                                                                           26
: tmp.2
  nd
  cr
  cr ." \ MEM HINTS     :"
  cr ." \        1.  Array      --- minor"                                 31
  cr ." \              old ver --- DAS        +  minor"
  cr ." \                          1C *8 *2"
  cr ." \        2.  Token      --- minor"
  cr ." \              old ver --- 1 cha +  FFT coef  + IFFT  +  w.h
     +  w.p"
  cr ." \                          1C *4   1C *2*2 *4   2C *8  1000 *4      36
     1000 *4"
  cr ." \        3.  Unnamed    --- [FFT]      +   Re[FFT]   ( > Ramp for
     PSD )"
  cr ." \                          1C *1*2*4    1C *1*1*4       1 ch *2*4
     "
  cr ." \        4.  DAS buf    --- 0"
  cr ." \"
  cr ." \ WRITTEN    --    " " Dec, 1990 by  Lee Yueon-Ron  (03/91, 11/93,  41
      02/94)"
  s.type
```



```
  cr
  cr ." \
     ================================================================="
;
tmp                                                                        46
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause                                                                  51
 tmp.s  my.pause.flag   ":=
\ forget tmp
\ stack.clear

\ tmp.2                                                                    56
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause                                                                  61
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear
```

LPAR.HLP


```
: tmp                                                                    1
  \ nd   ." resetpar"   cr
  nd
  cr ." \
      ================================================================="
  cr
  cr ." \ Reset parameter for Menu System"                               6
  cr
  cr ." \ Written : "   "  Mar. 1995, by Y.R. Lee" s.type
  cr ." \
      ================================================================="
;
tmp                                                                     11
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause                                                               16
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear
```

LLET.HLP

A01821-20161220-A024 ❖ December 20, 2016 ❖ [Page count: 1]

```
{29.line}
: tmp
  \ nd ." Llet"  cr
  nd
  cr ." \
      ------------------------------------------------------------------"
  cr ." \  The System for Wavelet Analysis is too huge and too
      complicated"
  cr ."              to be implemented in a menu driven system"
  cr ." \   "  " Complete, Powerful, and Strict" s.type ."  schemes,
      which include"
  cr ."              almost any kind of analyses are developed by the
      author."
  cr
  cr ." \  1   Wavelet transform (s.o, o.n)"
  cr ." \  2   Wavelet packet transform (o.n)"
  cr ." \  3.  Both forward and backward"
  cr ." \  4.  Implementing both periodic and aperiodic WT"
  cr ." \  5.  The periodic WT is reversable,"
  cr ." \           i.e., allows perfect reconstruction"
  cr ." \  6.  The aperiodic WT is optimized to reduce edge effects,"
  cr ."             its reconstruction may show differences from original
       data"
  cr ." \  7.  keywords:  indexing,  wrapping,  domains"
  cr ." \  8.  The CPU time used is much less than 'Numerical Recipe'
      book"
  cr ."             (More than "  " ten times faster" s.type ." )"
  cr ." \  9.  Complete analysis of spectral and wavelet coherences"
  cr
  cr ." \   "  " Copyright : Y.R. Lee"  s.type
  cr
  cr ." \
      ------------------------------------------------------------------
      "
;
tmp
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear
```

LCal.hlp


```
{29.line}                                                                    1
: tmp
\ cr ." : lsta-0 ;"   cr  nd
nd
."  ================================================================="
cr ."  \"                                                                  6
cr ."  \ Keywords       :  1. A Mutichannel voltmeter (up to 16 channels)
   "
cr ."  \                   2. Choice of Three different unit displays"
cr ."  \                   3. Check the hardware and software gain
   settings"
cr
cr ."  \ Written        :  " " Nov. 1993 by  Y-R Lee" s.type               11
cr
."  ================================================================="
;
tmp
 {29.line}                                                                  16
 my.pause.flag  tmp.s  ":=
 " y"  my.pause.flag   ":=
 bell.1sl
 my.pause
 tmp.s  my.pause.flag  ":=                                                  21
 forget tmp
 stack.clear
```

LAcq.hlp

A01823-20161220-A026 ❖ December 20, 2016 ❖ [Page count: 1]

```
{29.line}
: tmp
\ cr ." : lacq-0 ;"   cr  nd
nd
."  ======================================================================"
cr ."  \"
cr ."  \ Keywords      :"
cr ."  \ Multitasking  :  1. Data acqisition with One channel monitoring
   "
cr ."  \                  2. Multitasking operations"
cr ."  \                  3. Optimized time sequence control for low
   rate"
cr ."  \                  4. Better synchronization"
cr ."  \                  5. Safeguard of existing and new files"
cr ."  \                  6. Due to screen pixel restriction extremely
   high"
cr ."                          frequency signal may clutter the screen"
cr
cr ."  \ DMA           :  1. Virtually no limit of size"
cr ."  \                  2. Extremely high frequency (more than 100KS/s
   )"
cr ."  \                  3. Virtual disk technology"
cr ."  \                  4. Safeguard of existing and new files"
cr ."                        "
cr
cr ."  \ Written       :  " " Nov. 1993 by  Y-R Lee" s.type
cr
."
   ============================================================================
   "
;
tmp
\ hlp.com
 {29.line}
 my.pause.flag  tmp.s  ":=
 " y"  my.pause.flag   ":=
 bell.1sl
 my.pause
 tmp.s  my.pause.flag  ":=
 forget tmp
 stack.clear
```

LAnA.hlp


```
{29.line}
: tmp
\ cr ." : la&a-0 ;"   cr  nd
nd
."  ================================================================="
cr ."  \"
cr ."  \ Keywords       :  1. ANA ---  Various analysis"
cr ."  \                   2. A+A ---  Data acquisition and non stop
    analysis"
cr ."  \                               Choose any analyis you like"
cr ."  \                               Minimized key strokes"
cr ."  \                               Optional pause for viewing
    graphics"
cr ."  \ Written        :  " " Nov. 1993 by  Y-R Lee" s.type
cr
."  ================================================================="
;
tmp
\ hlp.com
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear
```

LMON.HLP

A01825-20161220-A028 ❖ December 20, 2016 ❖ [Page count: 1]

```
{29.line}
: tmp
\ cr ." : lsta-0 ;"    cr
nd
."  ======================================================================"
cr ."  \"
cr ."  \ Keywords       :  1. One channel high data rate monitoring"
cr ."  \                   2. Unlimited time duration"
cr ."  \                   3. Due to pixel restriction extremely high"
cr ."                            frequency signal may clutter the screen"
cr
cr ."  \ Written        :  " " Nov. 1993 by  Y-R Lee" s.type
cr
."  ======================================================================"
;
tmp
 {29.line}
 my.pause.flag  tmp.s   ":=
 " y"  my.pause.flag    ":=
 bell.1sl
 my.pause
 tmp.s  my.pause.flag   ":=
 forget tmp
 stack.clear
```

附錄二：　Mathematica 程 式

(* TFR-WPT Shell *)

(* by Ron Lee *)

† View Core File in NB Fmt | View Core File in M Fmt | View Original Single - File - Processing (the base of the core file)

† COLOR SCHEME (* Hyperlinks: Top | Colors | Files | Map | Signal | End *)

```
commondir = "g:\\all-mma\\common\\";
currentdir = "g:\\all-mma\\TFR-WP\\";
datadir = "c:\\per\\mat\\0-map\\data\\";
Get[commondir <> "SetNotebook_nb-m.m"](* Set notebook options *)
Clear["noext*"];
noextbat = "yes";
colorstyle = 1;  (* 0:B&W ; 1:Color*)
ampflag = 1;    (* 0:normal below ; 1:db below ; 2:db above 3:Log below*)
dbcutoff = 40;
huebeg = 0.15;  (* 0.5:blue ; 0.2:yellow *)
xstr = "Time (sec)";
ystr = "Signal";
```

```
(* runmap[x_]:={noextnew=x, <<"c:/per/mat/0-map/WP-Core_nb-m.m"}; *)
runmap[x_] := {noextnew = x, Get[currentdir <> "TFR-WP_Shell-Core.nb.m"]};
```

(* A Quasi Wavelet Basis Function for Refined Ridge Extraction*)

(* by Ron Lee *)

ü Files and Parameters

File Macro LeakOut LeakIn PhaseNoise Root Others End

```
<< "c:/lee/mat/Initial_SetNotebook.M" (* Set notebook options *)
<< "c:/lee/mat/Initial_Forms.M";
<< "c:/lee/mat/Initial_Frames.M";
<< "c:/lee/mat/Initial_Words.M";
FigDir = "G:\\Fig\\MMA\\WaveletVariantCharacterizations\\";
FigName = FigDir;
myfont = "Times";
$TextStyle = {FontFamily -> "Times", FontSize -> myfontsize};
timeflag = "Y";
dynamictimeflag = "N";
flabelflag = "Y";
flabelflag2 = "Y";
abcdflag = "N";
llabelflag = "y";
gridlineflag = "YY";
xyaxisflag = "LL";
stringposflag = 1 ;
xshiftflag = 0;
forcedstringaryflag = "n";
forcedflabelflag = "n" ;
stringindexmul = 3;
stringindexsin = 1;
abcdlabel = "a";
timeflag = "Y"; tlabel = tlabelv;
```

ü Macros

File Macro LeakOut LeakIn PhaseNoise Root Others End

```
doshowxy := {
  moutt[flabel];
  moutt[flabel2];
  myplot=ListPlot[ dataxy
    , PlotJoined->True
    , PlotRange->All
    , PlotStyle->{Thickness[0.0008] (* , Hue[0.0] *) }
    , Frame->True
```



```
    , DisplayFunction->Identity
  ];
  (* myshow; *)
   Display[PigName<>EpsStrTmp<>".eps", Graphics[myshow], "EPS"];
  (* Run["wmawav.bat"]; *)
  <<"c:/lee/mat/000-p2_nb-m.m"
};
```

```
flabel2 := typestr<>"α="<>StringTake[ToString[N[scap1,
9]],If[StringLength[ToString[N[scap1, 9]]]>=7, 7, 1] ]<>", β="<>ToString[N[
peakshiftp1,2]]<>"π, ξ="<>StringTake[
ToString[N[xi,2]],1]<>", (0↔"<>StringTake[ToString[N[xlimitp1, 2]],1]<>"π),
θ="<>ToString[N[phap1,3]]<>"π";
```

ü Leakage Out

File Macro LeakOut LeakIn PhaseNoise Root Others End

ü Leakage out (Wavelet variant)

```
(* -------- Frequency Leakage Out (Variant) --------- *)
typestr="Wavelet Variant: ";
xlabel="Scale";
ylabel="Projections at different wavelet scales";
flabel="Ambiguity Effects : Leakage OUT from a wave packet";
<<"c:/lee/mat/000-p1_nb-m.m";
frelkgout [peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
  1 / (scav) * NIntegrate[Cos[xiv*x]*Sin[xiv*x/scav]*
     Exp[-((x - peakshiftv/xiv)^2/scav^2 + (x)^2)/(2)],
     {x, 0, xlimitv}
  , MinRecursion->3, MaxRecursion->10
];
  (*  1 / scav * NIntegrate[Cos[x]*Sin[xiv * x/scav]*   (* a=sca/xi *)
       Exp[-((x/scav - peakshiftv/xiv )^2 + (x)^2)/(2)],
  *)
peakshiftp1=0.5;peakshift= peakshiftp1 * Pi;
xlimitp1=7;xlimit=xlimitp1 * Pi;
phap1=0;pha=phap1 * Pi;
xi=5;
scap1=1;
datax= Table[ ni , {ni, 0.025, 5, 0.025}];
datay= Table[ frelkgout [peakshift, sca, xlimit, pha, xi], {sca, 0.025 ,
5 , 0.025 } ];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="WV_LO";
doshowxy;
```

ü Leakage out (Morlet)

```
(* -------- Frequency Leakage Out (Morlet) ---------- *)
typestr="Morlet Wavelet: ";
xlabel="Scale";
ylabel="Projections at different wavelet scales";
flabel="Ambiguity Effects : Leakage OUT from a wave packet";
<<"c:/lee/mat/000-p1_nb-m.m";
(*
frelkginM[peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
   NIntegrate[Cos[u/scav]*Cos[(u)]*
     Exp[-((u - peakshiftv)^2+ (u/scav)^2)/(2*xiv^2)],
     {u, 0, xlimitv}
     , MinRecursion->3, MaxRecursion->10
];
*)
(*  There exists analytical form  *)
frelkgoutM [peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
  2*  1 / (scav) * Integrate[Cos[xiv*x]*Cos[xiv*x/scav]*
     Exp[-((x - peakshiftv/xiv)^2/scav^2 + (x)^2)/(2)],
     {x, 0, Infinity}
];
peakshiftp1=0;  peakshift= peakshiftp1 * Pi;
xlimitp1=7;  xlimit=xlimitp1 * Pi;
phap1=0;  pha=phap1 * Pi;
xi=5;
scap1=1;
dofrelkgoutM=frelkgoutM [peakshift, sca, xlimit, pha, xi](*analytical form*)

datax= Table[ ni , {ni, 0.000, 5, 0.025}];
datay= Table[ N[dofrelkgoutM], {sca, 0.000 , 5 , 0.025 } ];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="MW_LO";
doshowxy;
```

■ `<< "c:\\lee\\mat\\000-p1.m";`

$$\text{FindMinimum}\left[-1 * 1 / \text{sca} * \left(\left(E^{-\frac{25\,(-1+\text{sca})^2}{2\,(1+\text{sca}^2)}} + E^{-\frac{25\,(1+\text{sca})^2}{2\,(1+\text{sca}^2)}}\right)\sqrt{\frac{\pi}{2}}\,\sqrt{1+\frac{1}{\text{sca}^2}}\,\text{sca}^2\right) \Big/ (2\,(1+\text{sca}^2)),\ \{\text{sca},\ 0.97\}\right]$$

`<< "c:/lee/mat/000-p2_nb-m.m"`

ü Leakage In

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

. (* LEGENDS *)

```
beststr=Which[ bestflag===1,  "    [BEST BASIS]"
             , bestflag===2,  "    [BEST LEVEL "<>"("<>
               ToString[bestlevel]<>")"<>"]" ];

(* ------------------------------------------- *)
ibeg=If[ secbeg===1,  1, 2^(secbeg-1)+1 ];   (* index *)
iend=2^secend;
mouttn["Freq index (beg, end, {secbeg, secend}) : ",
                  {ibeg, iend, {secbeg, secend}} ];


tbeg=0. ;    (* absolute range of plot area *)
tend=2^npower ;
fbeg=If[ secbeg===1,  0, 2^(secbeg-1) ];
fend=2^secend ;

tbegstr="0.00";
tmidstr=StringTake[ToString[
           N[ 2^npower/sfreq/2+0.000001, 20]],4] ;
tendstr=StringTake[ToString[
           N[ 2^npower/sfreq  +0.000001, 20]],4] ;
fbegstr=If[ secbeg===1, "0.00", StringTake[ToString[
           N[ 2^(secbeg-1-npower)*sfreq/2+0.000001, 20]],4]  ] ;
fmidstr=If[ secbeg===1, StringTake[ToString[
           N[ 2^(secend-npower)*sfreq/2/2+0.000001, 20]], 4],
                    StringTake[ToString[
           N[(2^(secend-secbeg-npower)+ 2^(secbeg-1-npower))
                              *sfreq/2+0.000001, 20]],4] ] ;
fendstr=StringTake[ToString[
           N[ 2^(secend-npower)*sfreq/2+0.000001, 20]],4];
datelist=Date[];
gfdate=
    "("<>ToString[datelist[[1]]]<>"/"<>ToString[datelist[[2]]]<>
    "/"<>ToString[datelist[[3]]]<>"-"<>ToString[datelist[[4]]]<>
    ":"<>ToString[datelist[[5]]]<>":"<>ToString[datelist[[6]]]<>")";
lgnlb=Which[ ampflag===0, "Normalized Maganitude"
           , ampflag===1, "db Below Peak"
           , ampflag===2, "db Above Bottom"
           , ampflag===3, "Normalized Log Mag" (* poor resolution?! *)
           ]<>beststr;
lgnlb=StyleForm[lgnlb, FontFamily->myfont, FontSize->myfontsize+2 ];
lgnup=Which[ ampflag===0, "1"
           , ampflag===1, "0"
           , ampflag===2, ToString[ dbcutoff ]
           , ampflag===3, "1"
           ];
lgndn=Which[ ampflag===0, "0"
           , ampflag===1, ToString[ dbcutoff ]
           , ampflag===2, "0"
           , ampflag===3, "0"
           ];
```

(* FUNCTIONS *)

(* PLOT 1 *)

```
(* ------------------------------------------- *)
wpamp=Which[ ampflag===0, Abs[wpamp]
           , ampflag===1, Abs[wpamp]
           , ampflag===2, Abs[wpamp]
           , ampflag===3, Log[logbase, Abs[wpamp]]
           ];
(* shift log scale to >= 0 in the plot range *)
wpamp=Which[ ampflag===0, wpamp
           , ampflag===1, ( Log[logbase, Max[Take[wpamp, {ibeg, iend}]]]
                          - Log[logbase, wpamp] ) * 20. (*small->larger*)
           , ampflag===2, ( Log[logbase, wpamp]
                          - Log[logbase, Min[Take[wpamp, {ibeg, iend}]]]
                          ) * 20.  (* small->small*)
           , ampflag===3, Abs[Min[Take[wpamp, {ibeg, iend}]]]+wpamp
           ];
   (*ListPlot[Take[wpamp, {ibeg, iend}], PlotJoined->True, Frame->True]
   *)
(* normalizing to 0~1 *)
wpamp=Which[ ampflag===0, wpamp / Max[Take[wpamp, {ibeg, iend}]]
           , ampflag===1, ( dbcutoff - wpamp ) / dbcutoff
           , ampflag===2, ( dbcutoff - wpamp ) / dbcutoff
           , ampflag===3, wpamp / Max[Take[wpamp, {ibeg, iend}]]
           ];
(* trimming *)
champ=Which[ ampflag===0, wpamp
           , ampflag===1, Do[ If[wpamp[[x]]<0., wpamp[[x]]=0.
                          , wpamp[[x]]], {x, ibeg, iend, 1} ]
           , ampflag===2, Do[ If[wpamp[[x]]<0., wpamp[[x]]=0.
                          , wpamp[[x]]], {x, ibeg, iend, 1} ]
           , ampflag===3, wpamp
           ];
(* proper reverse *)
wpamp=Which[ ampflag===0, 1 - wpamp   (* higher amp is darker(0) *)
           , ampflag===1, 1 - wpamp
           , ampflag===2, wpamp
           , ampflag===3, 1 - wpamp
           ];
   (*Max[Take[wpamp, {ibeg, iend}]]
     Min[Take[wpamp, {ibeg, iend}]]
     ListPlot[Take[wpamp, {ibeg, iend}], PlotJoined->True, Frame->True]
   *)
wpamp=Which[ colorstyle===0, wpamp
           , colorstyle===1, 1-wpamp
           ];
(* scaling color *)
wpamp=Which[ colorstyle===0, wpamp
           , colorstyle===1, 1 - (1-wpamp) (1-huebeg)
           ];


(* ------------------------------------------- *)
gffunc[x_]:= Graphics[
    Which[
           colorstyle===1
```



```
           (* , {Hue[0, 1-wpamp[[x]], 1-wpamp[[x]]] *)
              , {Hue[wpamp[[x]]]
                                    , Rectangle[xymin[[x]], xymax[[x]]]}
              , colorstyle===0
              , {GrayLevel[wpamp[[x]]], Rectangle[xymin[[x]], xymax[[x]]]}
              ]
      ]


gftable=Table[gffunc[x], {x, ibeg, iend}];
```

```
(* ------------------------------------------- *)
gfaxis={
(*    ------------  For interger x and y coordinates
      Graphics[Text[FontForm["Time (sec)", {aft, afs}]
       , {(tend-tbeg)/2+tbeg, (fend-fbeg)*-0.12+fbeg } ]]
    , Graphics[Text[FontForm["Scale (~ Frequency in Hz)", {aft,afs}]
       , {(tend-tbeg)*-0.11+tbeg, (fend-fbeg)/2+fbeg }, {-1, 0}, {0, 1} ]]
    , Graphics[Text[FontForm[tbegstr,  {aft, afs}]
       , {  tbeg, (fend-fbeg)*-0.045+fbeg } ]]
    , Graphics[Text[FontForm[tmidstr, {aft, afs}]
       , {(tend-tbeg)/2+tbeg, (fend-fbeg)*-0.045+fbeg} ]]
    , Graphics[Line[{{(tend-tbeg)/2+tbeg, fbeg                  },
                    {(tend-tbeg)/2+tbeg, fbeg+(fend-fbeg)*-0.02}}] ]
    , Graphics[Text[FontForm[tendstr,  {aft, afs}]
       , { tend, (fend-fbeg)*-0.045+fbeg } ]]
    , Graphics[Text[FontForm[fbegstr,  {aft, afs}]
       , {(tend-tbeg)*-0.045+tbeg, fbeg} ]]
    , Graphics[Text[FontForm[fmidstr,  {aft, afs}]
       , {(tend-tbeg)*-0.045+tbeg, (fend-fbeg)/2+fbeg} ]]
    , Graphics[Line[{{tbeg,                     (fend-fbeg)/2+fbeg},
                    {tbeg+(tend-tbeg)*-0.02, (fend-fbeg)/2+fbeg}}] ]
    , Graphics[Text[FontForm[fendstr,  {aft, afs}]
       , {(tend-tbeg)*-0.045+tbeg, fend} ]]
    ,
      Graphics[
      Line[{{tbeg, fbeg}, {tend, fbeg},
            {tend, fend}, {tbeg, fend}, {tbeg, fbeg}}] ]
*)
      Graphics[
      Line[{{tbeg/sfreq, fbeg/fend*sfreq/2}, {tend/sfreq, fbeg/fend*sfreq/2},
            {tend/sfreq, fend/fend*sfreq/2}, {tbeg/sfreq, fend/fend*sfreq/2},
            {tbeg/sfreq, fbeg/fend*sfreq/2}}] ]
    };
```

(* PLOT 2 *)

```
(* ------------------------------------------- *)
gfshowmap=Show[    (* ShowLegend[ *)
     {
      gftable
    , gfaxis
     }
    , AspectRatio->1/aspectratiox
    , TextStyle->{FontFamily->myfont, FontSize->myfontsize}
    , Frame->True
    , FrameLabel->{"Time (sec)", "Scale (~ frequency in Hz)"}
    , PlotLabel->
      StyleForm["W.P. PHASE PLANE "<>"["<>ToUpperCase[wlet]<>"--"<>
                nowfile<>" ("<>
                ToString[npower]<>","<>ToString[jwplevel]<>")"<>
                "] "<>gfdate,
                FontFamily->myfont, FontSize->myfontsize ]
    , DisplayFunction->Identity
  (*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
    , Background->Hue[0.6]
    , PlotRegion->{{-0.1,1.1},{-0.1,1.1}}
    ---------------------------------------------------------------------
  *)
   ];
```



```
pmap=ShowLegend[
    gfshowmap
    , Which[
            colorstyle===1
      (* ,  {Hue[0, #, #]&, 30, lgnup, lgndn *)
         ,  {Hue[1-(#)(1-huebeg)]&, 30, lgnup, lgndn
           , LegendBorderSpace -> 0.2
           , LegendOrientation->Horizontal
           , LegendPosition->{-0.81, +lgnposy}
           , LegendSize->{1.7, 0.10}
           , LegendTextOffset->{0.0, -0.70}
           , LegendLabel->lgnlb
           , LegendLabelSpace->+2.65
           , LegendShadow->{0.01, 0.01}
(*
           , LegendBorderSpace -> 0.2
           , LegendOrientation->Horizontal
           , LegendPosition->{-0.77, +0.75}
           , LegendSize->{1.5, 0.10}
           , LegendTextOffset->{0.0, -1.00}
           , LegendLabel->lgnlb
           , LegendLabelSpace->+2.65
           , LegendShadow->{0.01, 0.01}
*)
           }
         , colorstyle===0
           , {GrayLevel[#]&, 30, lgnup, lgndn
           (*  , LegendBorderSpace -> 0.8  for 60  *)
           , LegendBorderSpace -> 0.2
           , LegendOrientation->Horizontal
           , LegendPosition->{-0.81, +lgnposy}
           , LegendSize->{1.7, 0.10}
           , LegendTextOffset->{0.0, -0.70}
           , LegendLabel->lgnlb
           , LegendLabelSpace->+2.65
           , LegendShadow->{0.01, 0.01}
           }
         ]
    , ImageSize->{imagesizex,imagesizey}
    , DisplayFunction->Identity
    ];



(* ------------------------------------------- *)
p2=Show[
   {
    ListPlot[ wpsig
    (* p2=ListPlot[ wpsig  *)
    , PlotJoined->True
    , AspectRatio->1/aspectratiox
    , Frame->True
    , FrameLabel->
      If[ StringMatchQ[StringTake[noext, -1 ], "4"
          ] || StringMatchQ[StringTake[noext, -1 ], "2"]
        , { "Time (sec)",
            If[ StringMatchQ[StringTake[noext, -1 ], "4"]
               , "Displacement (cm)"
               , "Acqueous flow (cm/sec)" ]
          }
      (*  , {"X value",  " Y value"}  *)
        , {xstr, ystr}
      ]
    , PlotLabel->
      StyleForm[" "<>"["<>noext<>
```

```
                "] "<>gfdate,
                FontFamily->myfont, FontSize->myfontsize ]
    , ImageSize->{imagesizex,imagesizey}
    , DisplayFunction->Identity
    ]
  }
  ] ;
(* ------------------------------------------- *)
prule=Graphics[Line[{{0.0,0.0},{0.5,0.5}}]
    , DisplayFunction->Identity
    ];
```

. (* RENDERING *)

```
StylePrint["Map", "Graphics"
          , CellFrame->True, Background->GrayLevel[0.9], FontSize->10
          , CellTags->"Map"
          ];
Show[Graphics[pmap]
    , DisplayFunction->$DisplayFunction];
Display[FigName<>"Map"<>".eps", Graphics[pmap], "EPS"]
(*
StylePrint[
Show[Graphics[pmap]
    , DisplayFunction->$DisplayFunction];
          , "Graphics", CellTags->"Map"
          ];
*)

(*   ------------  For interger x and y coordinates   *)
(*
Show[Graphics[{ Rectangle[{0.045, 0.00}, {0.975, 1.00}, p2]
              , Rectangle[{0.000, 0.0}, {0.0000001, 0.0000001}, prule]
              , Rectangle[{0.999, 0.0}, {0.9990001, 0.0000001}, prule]
    } ]] ;
*)
Get[commondir<>"000-p2_nb-m.m"];
lgnlbsig=
  StyleForm["Signal"<>" (CPU="<>
          ToString[hrd]<>":"<>ToString[mind]<>":"<>
          ToString[secd]<>")",
          FontFamily->myfont, FontSize->myfontsize+2 ];
p4=ShowLegend[
    p2  (* %  *)
    , Which[
          colorstyle===1
          (* , {Hue[0, #, #]&, 10, lgnup, lgndn *)
          (* , {Hue[1-(#)(1-huebeg)]&, 30, lgnup, lgndn  *)
          (* , {Hue[0.75]&, 30, " ", " "  *)
          , {GrayLevel[0]&, 30, " ",  " "
          , LegendBorderSpace -> 0.8
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.81, +lgnposy}
          , LegendSize->{1.7, 0.10}
          , LegendTextOffset->{0.0, -0.70}
          , LegendLabel->lgnlbsig
          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
(*
          , LegendBorderSpace -> 0.8
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.77, +0.75}
```



```
          , LegendSize->{1.5, 0.10}
          , LegendTextOffset->{0.0, -1.00}
          , LegendLabel->"Signal"<>" (CPU="<>
            ToString[hrc]<>":"<>ToString[minc]<>":"<>
            ToString[secc]<>")"
          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
*)
          }
        , colorstyle===0
          , {GrayLevel[0]&, 30, " ",  " "
          , LegendBorderSpace -> 0.8
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.81, +lgnposy}
          , LegendSize->{1.7, 0.10}
          , LegendTextOffset->{0.0, -0.70}
          , LegendLabel->lgnlbsig
          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
          }
        ]
    , ImageSize->{imagesizex,imagesizey}
    , DisplayFunction->Identity
    ];
StylePrint["Signal", "Graphics"
          , CellFrame->True, Background->GrayLevel[0.9], FontSize->10
          , CellTags->"Signal"
          ];
Show[Graphics[p4]
    , DisplayFunction->$DisplayFunction
    ];
Display[FigName<>"Signal"<>".eps", Graphics[p4], "EPS"]

Get[commondir<>"000-p2_nb-m.m"]
Get[commondir<>"000-p3.m"]  (* Hyperlinks: Top Files Colors Map Signal End
```

. (* Hyperlinks: Top Files Colors Map Signal End *)

(* WVTR Shell *)

(* by Ron Lee *)

(*! IMPORTANT: Firstly, run non-shell to initialze properly !*)

View Core File in NB Fmt | View Core File in M Fmt

View Stand Alone Single - File Processing (the base of the core file)

datafilename = **WV-Demo** (*0:forDefault;Allothers:specify*)

datafilename = 0; (*0:forDefault;Allothers:specify*)

Hyperlinks : Files | Parameters | Modulus | Phase | Signal | 3 DModulus | 3 DPhase | End

```
datafilename = "0"; (* "0" : for Default;  All others : specify *)
```

```
commondir = "g:\\all-mma\\common\\";
currentdir = "g:\\all-mma\\TFR-WV\\";
datadir = "c:\\per\\mat\\0-CWT\\data\\";
Get[commondir <> "SetNotebook_nb-m.m"](* Set notebook options *)
Clear["noext*"];  noextbat = "yes";
```

COLOR SCHEME

■ Modulus

```
colorstylemod = 1; (* 0:B&W; 1:Color *)
huebegmod = 0.5;   (* 0.5:Blue; 0.2:Yellow *)
ampflagmod = 1;
(* 0:Normal below; 1:db Below; 3:db Above; 4:Log Below *)
dbcutoffmod = 40;
```


■ Phase

```
colorstylepha = 0 ; (* 0:B&W; 1:Color *)huebegpha = 0.0 ;
(* 0.5:Blue; 0.2:Yellow *)
ampflagpha = 0;
(* 0:Normal below; 1:db Below; 3:db Above; 4:Log Below *)
dbcutoffpha = 40;
(* Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End *)
```

■ 3D

```
flag3dpha = "yes"; (* yes/no *)
flag3dmod = "yes"; (* yes/no *)
xstr = "Time (sec)";
ystr = "Signal";
```

BATCH PROCESSING takes "data file" and ".M file".

```
(* runcwt[x_]:={noextnew=x,<<"g:/all-mma/cwt/Acwt-core_nb-m.m"}; *)
(* runcwt[x_]:={noextnew=x,Get[currentdir<>"Acwt-core_nb-m.m"]}; *)
runcwt[x_] := {noextnew = x, Get[currentdir <> "TFR-WV_Shell-Core.nb.m"]};
runcwt[datafilename];
(* Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End *)
```

(* Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End *)

```
(* ---------------- Reserved ---- ------------ *)
```

(* Wavelet Variant Transform and Adaptive CWT Renditions *)

(* by Ron Lee *)

(*
Notes on Shell Processing OR Single-file Stand-alone Processing:

This file is also the base of the core file for WVTR shell in ".nb" format (View Shell File in NB Fmt). It needs to be converted to "text (.M)" format for use in WVTR shell (View Shell's Core File in M Fmt).

A: For Single-file Stand-alone Processing:
Add ' noextbat="no"' and optionally ' noext="datafilename" ' to cell labeled as 'Shell processing OR Single-file processing'
B: For Shell Processing:
Steps for Making the M-file:
0: Rename this file as the Shell's core file in nb fmt (e.g., WVTR_Shell-Core.nb).
1. Comment out all elements in the cell labeled as 'Shell Processing OR Single-file Processing
2. Delete all outputs
3. Remove In/Out names
4. Just "saved as special -> text ->, ?.m" (e.g., WVTR_Shell-Core.nb.m)
5. Put the M fmt file name in shell (e.g., WVTR_Shell.nb).
Done!
*)

† (* DISPLAY SCHEME *)
(* Hyperlinks:
Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End *)

```
commondir = "g:\\all-mma\\common\\";
currentdir = "g:\\all-mma\\TFR-WV\\";
datadir = "c:\\per\\mat\\0-CWT\\data\\";
FigDir = "G:\\Fig\\MMA\\TFR-WV\\";
Get[commondir <> "000-p1_nb-m.m"];
Get[commondir <> "Run-form-lw.m"];
Get[commondir <> "fig-fram_nb-m.m"];
Get[commondir <> "000-word_nb-m.m"];
If[ runcount > 0
  , { mouttn["This is RUN No : ", ++runcount],
    Remove["p*", "fun*", "*wp*", "gf*", "lgn*"] }
  , mouttn["No case shall ever go here.", 999]
  , { runcount = 1, mouttn["This is RUN No : ", runcount] }
 ];
Off[General::spell1]; Off[Generalspell];
SetOptions[ SelectedNotebook[], ShowPageBreaks -> True,
    WindowToolbars -> {"LinksBar" , "RulerBar", "EditBar"}];
<< "e:/math/4.0/addons/standardpackages/graphics/legend.m"
datadir = "c:/per/mat/0-cwt/data/";
currentfile = ReadList[datadir <> "cur-cwt.fip", String];
```

```
(*
noext="envelope";
noext="chirp-de";  (* inverse decreasing freq ~ 1/t *)
```



```
noext="chirp-ny";  (* Nyqust sampling *)
noext="q1w60202";
noext="chirp-n2";  (* Nyqust sampling -- variable  sai *)
noext="chirp-n1";  (* Nyqust sampling -- fixed     sai *)
noext="chirp-n3";
noext="chi-vari";
noext="chi-fixe";
noext="bif-fixe";
noext="bif-vari";
noext="test-cwt"
noext="test";
Clear["noext*"];
*)
```

```
noext=currentfile[[1]];
```

```
(* Shell Processing OR Single-file Processing *)
```

```
(* (View Shell File in NB Fmt)  (View Shell's Core File in M Fmt) *)
(*
(* Not Used in m file. And may not needed in nb file either. *)
noextbat="no";
noext="test";
noext="CWT-Demo";
*)
(* Hyperlinks: Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End *)
noextbat="no";
```

```
Which[noextbat === "yes",
   Which[noextnew === "0", noext = currentfile[[1]],
         noextnew =!= "0", noext = noextnew ] ];
noext = datadir <> noext;
mouttt["Data file" <>
         Which[ noextbat =!= "yes", " (Default-A  or  Assigned) : ",
         noextbat === "yes",
                    Which[noextnew === "0", " (Default-B) : ",
                  noextnew =!= "0", " (Assigned) : "] ], noext];
```

```
(* Hyperlinks:
  Files  Parameters  Modulus  Phase  Signal  3 DModulus  3 DPhase  End *)

(* ============== Parameters for Display Schemes ================== *)
(* *)                  (*  "yes" in .m file *)
Which[noextbat=!="yes",
   {
   colorstylemod=0;   (* 0:B&W; 1:Color *)
   huebegmod=0.5;     (* 0.5:blue ; 0.2:yellow *)
   ampflagmod=1;      (* 0:normal below ; 1:DB below ; 2:db above 3:Log below*)
   dbcutoffmod=40;
   colorstylepha=0;   (* 0:B&W; 1:Color *)
   huebegpha=0.0;     (* 0.5:blue ; 0.2:yellow *)
   ampflagpha=0;      (* 0:normal below ; 1:DB below ; 2:db above 3:Log below*)
   dbcutoffpha=40;
   flag3dmod="yes";
   flag3dpha="yes";
   xstr="Time (sec)";
   ystr="Signal";
   } ];
(* *)
```



```
iinc=1 ;
jinc=1;logbase=10.;
secbeg=1;
colorstyle=colorstylemod;huebeg=huebegmod; (* initializing color for modulus*)
ampflag=ampflagmod;dbcutoff=dbcutoffmod;
```

```
(* AUTO INPUT OF  DETAILS *)
```

```
(* ===== Auto Input of Complete ASYST Program Details and Data ===== *)
wpsig=ReadList[noext<>".sic", Number];
wpamp=ReadList[noext<>".amc", Number, RecordLists->True];
wppha=ReadList[noext<>".phc", Number, RecordLists->True];
wpsca=ReadList[noext<>".scc", Number, RecordLists->True];
wpspe=ReadList[noext<>".spc", Number];
wpstr=ReadList[noext<>".stc", String];
phaswitchflag=wpstr[[4]]; (* For ridge extraction *)
npower=wpspe[[1]];
jwplevel=wpspe[[2]];
bestflag=wpspe[[3]];
bestlevel=wpspe[[4]];
sfreq=wpspe[[5]];mouttn["Sampling Rate : ", sfreq];
matpower=wpspe[[6]];
matinc=wpspe[[7]];
wpsigx=Table[ x/sfreq, {x, 1, 2^npower, 1}] ;
(* wpsigx=Table[ x/sfreq, {x, 1, 2^npower, matinc}] ; *)
wpsigy=wpsig ;
ntmp=Dimensions[wpsig];
mouttn["(mat_power, mat_inc, size) : ", {matpower, matinc, ntmp}];
wpsig=Table[ {wpsigx[[x]], wpsigy[[x]]}, {x, 1, 2^npower, 1} ] ;
(* wpsig=Table[ {wpsigx[[x]], wpsigy[[x]]}, {x, 1, 2^matpower, matinc} ] ; *)
wlet=wpstr[[1]];
nowfile=wpstr[[2]];

FigName=FigDir<>nowfile<>"_"<>wlet<>"_"
```

† (* RESET *)

```
ibeg=If[ secbeg===1,  1, 2^(secbeg-1)+1 ];   (* index *)
iend=2^matpower;
ntmp=Dimensions[ wpamp ];mouttn["Dimension of WPamp : ", ntmp];

jbeg=1;
jend=Dimensions[ wpamp ][[2]];mouttn["Freq index range : ", {jbeg, jend}];

(*
jbeg=1
jend=40
jinc=1
*)
(* Set image size
myfontsize=10;
setis={imagesizex=432,imagesizey=imagesizex/1.,myfontsize=10,
       aspectratiox=1.11,lgnposy=0.99};
*)
setis={imagesizex=360,imagesizey=imagesizex/1.4,myfontsize=8,
       aspectratiox=1.55,lgnposy=0.70};
myfont = "Times";
$TextStyle = {FontFamily -> "Times", FontSize -> myfontsize};
```

```
(* ------------------------------------------------ *)

tbeg=0. ;    (* absolute range of plot area *)
tend=2^npower ;
tend=2^matpower;mouttn["Time range : ", {tbeg, tend}];
fbeg=Part[wpsca, 1, jbeg];
fend=Part[wpsca, 1, jend];
(* fbeg=fbeg- (fend-fbeg)/(Part[Dimensions[ wpsca[[1]] ], 1]-1); *)
fbeg=fbeg- (fend-fbeg)/(jend-jbeg);
saibeg=wpsca[[3,jbeg]];
saiend=wpsca[[3,jend]];
```


† (* LEGENDS *)

```
(* beststr="   [CWT  Amplitude]"; (*   "    [CWT  Modulus]";  *) *)
Which[ phaswitchflag==="O", beststr="   [WV Amplitude]"
     , phaswitchflag==="N", beststr="   [ACWT Amplitude]"
     ];
tbegstr="0.00";
tmidstr=StringTake[ToString[
           N[ 2^npower/sfreq/2+0.000001, 20]],4] ;
tendstr=StringTake[ToString[
           N[ 2^npower/sfreq  +0.000001, 20]],4] ;
fbegstr=StringTake[ToString[
           N[ fbeg + 0.0010001, 20]],4];
fmidstr=StringTake[ToString[
           N[ fbeg+(fend-fbeg)/2. + 0.0010001, 20]], 4];
fendstr=StringTake[ToString[
           N[ fend + 0.001001, 20]],4];
datelist=Date[];
gfdate=
    "("<>ToString[datelist[[1]]]<>"/"<>ToString[datelist[[2]]]<>
    "/"<>ToString[datelist[[3]]]<>"-"<>ToString[datelist[[4]]]<>
    ":"<>ToString[datelist[[5]]]<>":"<>ToString[datelist[[6]]]<>")";
```

† (* FUNCTIONS *)

```
func1[fwpamp_]:=
      Which[ ampflag===0, Abs[fwpamp]
           , ampflag===1, Abs[fwpamp]
           , ampflag===2, Abs[fwpamp]
           , ampflag===3, Log[logbase, Abs[fwpamp]]
           ];
(* shift log scale to >= 0 in the plot range *)
func2[fwpamp_]:=
      Which[ ampflag===0, fwpamp
           , ampflag===1,
             ( Log[logbase,
                   Max[fwpamp[[ Range[ibeg, iend], Range[jbeg, jend] ]] ]]
               - Log[logbase, fwpamp] ) * 20. (*small->larger*)
           , ampflag===2,
             ( Log[logbase, fwpamp]
             - Log[logbase,
                   Min[fwpamp[[ Range[ibeg, iend], Range[jbeg, jend] ]] ]]
             ) * 20.  (* small->small*)
           , ampflag===3,
             Abs[Min[fwpamp[[ Range[ibeg, iend], Range[jbeg, jend] ]] ]]
             + fwpamp
           ];
   (* ListPlot[Take[fwpamp, {ibeg, iend}], PlotJoined->True, Frame->True]
   *)

(* normalizing to 0~1 *)
func3[fwpamp_]:=
      Which[ ampflag===0, fwpamp /
                   Max[ fwpamp[[ Range[ibeg, iend], Range[jbeg, jend] ]] ]
           , ampflag===1, ( dbcutoff - fwpamp ) / dbcutoff
           , ampflag===2, ( dbcutoff - fwpamp ) / dbcutoff
           , ampflag===3,
                   Max[ fwpamp[[ Range[ibeg, iend], Range[jbeg, jend] ]] ]
           ];
(* trimming *)
func4[fwpamp_]:=  (* error -- not a function *)
(* champ=Which[ ampflag===0, fwpamp *)
      Which[ ampflag===0, fwpamp
           , ampflag===1, Do[Do[ If[ fwpamp[[x, y]]<0., fwpamp[[x, y]]=0.
                               , fwpamp[[x, y]] ], {x, ibeg, iend, 1} ]
                               , {y, jbeg, jend, 1} ]
           , ampflag===2, Do[Do[ If [fwpamp[[x, y]]<0., fwpamp[[x, y]]=0.
                               , fwpamp[[x, y]] ], {x, ibeg, iend, 1} ]
                               , {y, jbeg, jend, 1} ]
           , ampflag===3, fwpamp
           ];
(* proper reverse *)
func5[fwpamp_]:=
      Which[ ampflag===0, 1 - fwpamp   (* higher amp is darker(0) *)
           , ampflag===1, 1 - fwpamp
           , ampflag===2, fwpamp
           , ampflag===3, 1 - fwpamp
           ];
   (*Max[Take[fwpamp, {ibeg, iend}]]
     Min[Take[fwpamp, {ibeg, iend}]]
```



```
     ListPlot[Take[fwpamp, {ibeg, iend}], PlotJoined->True, Frame->True]
   *)
func6[fwpamp_]:=
      Which[ colorstyle===0, fwpamp
           , colorstyle===1, 1-fwpamp
           ];
(* scaling color *)
func7[fwpamp_]:=
      Which[ colorstyle===0, fwpamp
           , colorstyle===1, 1 - (1-fwpamp) (1-huebeg)
           ];
deltafre=fend-fbeg;
xymin=Table[{(i-1)*iinc*matinc/sfreq,
             ((j-1)-0)/(jend-(jbeg-1))*deltafre*jinc+fbeg},
             {i, (iend-(ibeg-1))/iinc},
             {j, (jend-(jbeg-1))/jinc}];
xymax=Table[{i    *iinc*matinc/sfreq,
             ((j  )-0)/(jend-(jbeg-1))*deltafre*jinc+fbeg},
             {i, (iend-(ibeg-1))/iinc},
             {j, (jend-(jbeg-1))/jinc}];
(*
xymin=Table[{(i-1)*iinc, ((j-1)-0)/(jend-(jbeg-1))*deltafre*jinc+fbeg},
             {i, (iend-(ibeg-1))/iinc}, {j, (jend-(jbeg-1))/jinc}];
xymax=Table[{i    *iinc, ((j  )-0)/(jend-(jbeg-1))*deltafre*jinc+fbeg},
             {i, (iend-(ibeg-1))/iinc}, {j, (jend-(jbeg-1))/jinc}];
*)
(* ------------------------------------------- *)
gffunc[x_, y_]:= Graphics[
    Which[
           colorstyle===1
      (* , {Hue[0, 1-wpamp[[x,y]], 1-wpamp[[x,y]]] *)
         , {Hue[wpamp[[(x-1)*iinc+ibeg, (y-1)*jinc+jbeg]]]
                     , Rectangle[xymin[[x,y]], xymax[[x,y]]]}
         , colorstyle===0
         , {GrayLevel[wpamp[[(x-1)*iinc+ibeg, (y-1)*jinc+jbeg]]]
                     , Rectangle[xymin[[x,y]], xymax[[x,y]]]}
         ]
    ]
gftable=Table[gffunc[x,y],
        {x,1,(iend-(ibeg-1))/iinc, 1}, {y,1,(jend-(jbeg-1))/jinc,1}];

(* ------------------------------------------- *)
gfaxis={
      Graphics[
      {
        Hue[0.75],
        Line[{{tbeg*matinc/sfreq, fbeg}, {tend*matinc/sfreq, fbeg},
            {tend*matinc/sfreq, fend}, {tbeg*matinc/sfreq, fend},
            {tbeg*matinc/sfreq, fbeg}}
        ]
      }
      ]
(*  , Graphics[ {GrayLevel[1.0], Rectangle[{tbeg,fbeg}, {tend,fend}]} ] *)
    };
```

† (* PLOT 1 *)

```
(*
wpamp=func1[wpamp];
wpamp=func2[wpamp];
wpamp=func3[wpamp];
*)
wpamp=func3[func2[func1[wpamp]]];

(* wpamp=func4[wpamp]; *)  (* error *)
(* func4[wpamp] *)   (* error *)
champ=Which[ ampflag===0, wpamp
           , ampflag===1, Do[Do[ If[ wpamp[[x, y]]<0., wpamp[[x, y]]=0.
                               , wpamp[[x, y]] ], {x, ibeg, iend, 1} ]
                               , {y, jbeg, jend, 1} ]
           , ampflag===2, Do[Do[ If [wpamp[[x, y]]<0., wpamp[[x, y]]=0.
                               , wpamp[[x, y]] ], {x, ibeg, iend, 1} ]
                               , {y, jbeg, jend, 1} ]
           , ampflag===3, wpamp
           ];
(*
wpamp=func5[wpamp];
wpamp=func6[wpamp];
wpamp=func7[wpamp];
*)
wpamp=func7[func6[func5[wpamp]]];

ampary=1-Transpose[wpamp];
gftable=Table[gffunc[x,y],
         {x,1,(iend-(ibeg-1))/iinc, 1}, {y,1,(jend-(jbeg-1))/jinc,1}];
lgnlbmod=Which[ ampflag===0, "Normalized Magnitude"
              , ampflag===1, "db Below Peak"
              , ampflag===2, "db Above Bottom"
              , ampflag===3, "Normalized Log Mag" (* poor resolution?! *)
              ]<>beststr;
(* lgnlbmod=FontForm[lgnlbmod, {myfont, myfontsize}];
lgnlbmod=StyleForm[lgnlbmod, FontFamily->"Times", FontSize->8 ]; *)
lgnlbmod=StyleForm[lgnlbmod, FontFamily->myfont, FontSize->myfontsize+2 ];
lgnupmod=Which[ ampflag===0, "1"
              , ampflag===1, "0"
              , ampflag===2, ToString[ dbcutoff ]
              , ampflag===3, "1"
              ];
(* lgnupmod=FontForm[lgnupmod, {myfont, myfontsize}] ---> error *)
lgndnmod=Which[ ampflag===0, "0"
              , ampflag===1, ToString[ dbcutoff ]
              , ampflag===2, "0"
              , ampflag===3, "0"
              ];

colorstyle=colorstylemod;huebeg=huebegmod;
gfshowmod=Show[   (* ShowLegend[ *)
    {
      gftable
    (* Graphics[ Raster[ Transpose[ wpamp ] ]]  *)
    , gfaxis
    }
    , AspectRatio->1/aspectratiox
(*
    , AspectRatio->1/1.8   (* 1.5   *)
    , AspectRatio->1/GoldenRatio   (* 1.5   *)
```



```
*)
    , Frame->True
    , FrameLabel->{"Time (sec)", "Scale (~ frequency in Hz)"}
    , PlotLabel->
    (*StyleForm["Modulus  "<>"["<>wlet<>", "<>nowfile<>" ("<> *)
      StyleForm[            "["<>wlet<>", "<>nowfile<>" ("<>
                 StringTake[ToString[N[saibeg+ 0.0001, 10]],4]<>","<>
                 StringTake[ToString[N[saiend+ 0.0001, 10]],4]<>")"<>
                 phaswitchflag<>"] "<>gfdate,
                 FontFamily->myfont, FontSize->myfontsize ]
    , DisplayFunction->Identity
    , TextStyle->{FontFamily->myfont, FontSize->myfontsize}
  (*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
    , Background->Hue[0.6]
    , PlotRegion->{{-0.1,1.1},{-0.1,1.1}}
    ----------------------------------------------------------------------
  *)
   ];


(* PLOT 2 *)

colorstyle=colorstylepha;huebeg=huebegpha;  (* initializing color for phase*)
ampflag=ampflagpha;dbcutoff=dbcutoffpha;
(* colorstyle=0;  (* 0:B&W ; 1:Color*)
ampflag=0;     (* 0:normal below ; 1:DB below ; 2:db above 3:Log below*)
dbcutoff=40;
huebeg=0.0;    (* 0.5:blue ; 0.2:yellow *)
huebeg=huebegpha;    (* 0.5:blue ; 0.2:yellow *) *)


wpamp=wppha;
wpamp=func3[func2[func1[wpamp]]];

champ=Which[ ampflag===0, wpamp
           , ampflag===1, Do[Do[ If[ wpamp[[x, y]]<0., wpamp[[x, y]]=0.
                               , wpamp[[x, y]] ], {x, ibeg, iend, 1} ]
                               , {y, jbeg, jend, 1} ]
           , ampflag===2, Do[Do[ If [wpamp[[x, y]]<0., wpamp[[x, y]]=0.
                               , wpamp[[x, y]] ], {x, ibeg, iend, 1} ]
                               , {y, jbeg, jend, 1} ]
           , ampflag===3, wpamp
           ];

wpamp=func7[func6[func5[wpamp]]];

(* phaary=Transpose[wpamp]; *)
phaary=Transpose[wppha];

gftable=Table[gffunc[x,y],
         {x,1,(iend-(ibeg-1))/iinc, 1}, {y,1,(jend-(jbeg-1))/jinc,1}];
(* beststr="   [CWT  Phase]"; *)
Which[ phaswitchflag==="O", beststr="   [WV Phase]"
     , phaswitchflag==="N", beststr="   [ACWT Phase]"
     ];
lgnlb=Which[ ampflag===0, "Radian"  (* "Normalized Magnitude" *)
           , ampflag===1, "db Below Peak"
           , ampflag===2, "db Above Bottom"
```

```
          , ampflag===3, "Normalized Log Mag" (* poor resolution?! *)
          ]<>beststr;
lgnlb=StyleForm[lgnlb, FontFamily->myfont, FontSize->myfontsize+2 ];
lgnup=Which[ ampflag===0, "2Pi"    (* "1" *)
          , ampflag===1, "0"
          , ampflag===2, ToString[ dbcutoff ]
          , ampflag===3, "1"
          ];
lgndn=Which[ ampflag===0, "0"
          , ampflag===1, ToString[ dbcutoff ]
          , ampflag===2, "0"
          , ampflag===3, "0"
          ];

colorstyle=colorstylepha;huebeg=huebegpha;
gfshowpha=Show[   (* ShowLegend[ *)
    {
     gftable
    , gfaxis
    }
    , AspectRatio->1/aspectratiox
    , Frame->True
    , FrameLabel->{"Time (sec)", "Scale (~ frequency in Hz)"}
    , PlotLabel->
    (*StyleForm["Phase  "<>"["<>wlet<>","<>nowfile<>" ("<> *)
      StyleForm[          "["<>wlet<>","<>nowfile<>" ("<>
                StringTake[ToString[N[saibeg+ 0.0001, 10]],4]<>","<>
                StringTake[ToString[N[saiend+ 0.0001, 10]],4]<>")"<>
                phaswitchflag<>"] "<>gfdate,
                FontFamily->myfont, FontSize->myfontsize
               ]
    , DisplayFunction->Identity
  (*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
    , Frame->True
    , FrameLabel->{"Time", "Scale"}
    , AxesLabel->{"Time", "Scale"}
    , Background->Hue[0.6]
    , PlotRegion->{{-0.1,1.1},{-0.1,1.1}}
    ----------------------------------------------------------------------
  *)
   ];
```

† (* PLOT 3 *)

```
(* ------------------------------------------- *)
(* ------------------------------------------- *)
prule=Graphics[Line[{{0.0,0.0},{0.5,0.5}}]
    , DisplayFunction->Identity
    ];
```


† (* 3D PLOTS *)

```
xtdiv=4; ytdiv=4;
xtspa=Which[ matpower===6, 15
           , matpower===7, 25
           , matpower===8, 50
           , matpower===9, 100
           ];
(*
xttab=Table[
     {iend*x/xtdiv,
      StringTake[ToString[N[tend*matinc/sfreq*x/xtdiv+0.0001001, 6]], 4]},
      {x, 0, xtdiv, 1} ];
*)
xttab=Table[
     {If[ xtspa*x===0, 1, xtspa*x ],
      StringTake[ToString[N[tend*matinc/sfreq*xtspa*x/iend+0.000101, 6]], 4]},
      {x, 0, xtdiv, 1} ];
yttab=Table[
     {If[ jend*y/ytdiv===0, 1, jend*y/ytdiv ],
      StringTake[ToString[N[(fend-fbeg)*y/ytdiv+fbeg+0.000101, 6]], 4]},
      {y, 0, ytdiv, 1} ];
ztab={{0,"0"},{3.1416,"Pi"},{6.283,"2Pi"}};
```

```
(* $DefaultFont={aft,afs}; *)

colorstyle=colorstylemod;huebeg=huebegmod;
StylePrint["Beginning of Plots", "Graphics", CellTags->"Beginning of plots", CellFrame->True];

StylePrint[
pmod=  (* ------------------------------------------------------------ *)
ShowLegend[
    gfshowmod
    , Which[
           colorstyle===1
      (* , {Hue[0, #, #]&, 10, lgnupmod, lgndnmod *)
         , {Hue[1-(#)(1-huebeg)]&, 30, lgnupmod, lgndnmod
           , LegendBorderSpace -> 0.2
           , LegendOrientation->Horizontal
           , LegendPosition->{-0.81, +lgnposy}
           , LegendSize->{1.7, 0.10}
           , LegendTextOffset->{0.0, -0.70}
           , LegendLabel->lgnlbmod
           , LegendLabelSpace->+2.65
           , LegendShadow->{0.01, 0.01}
           }
         , colorstyle===0
           , {GrayLevel[#]&, 30, lgnupmod, lgndnmod
           , LegendBorderSpace -> 0.2
           , LegendOrientation->Horizontal
           , LegendPosition->{-0.81, +lgnposy}
           , LegendSize->{1.7, 0.10}
           , LegendTextOffset->{0.0, -0.70}
           , LegendLabel->lgnlbmod
           , LegendLabelSpace->+2.65
           , LegendShadow->{0.01, 0.01}
```

```
            }
          ]
    , ImageSize->{imagesizex,imagesizey}
(*
    , TextStyle->{FontFamily->myfont, FontSize->myfontsize}
    , ImageSize->{432, 432 / 2 }
    , ImageSize->{432, 432 / GoldenRatio}
    , TextStyle->{FontFamily->myfont, FontSize->20}
    , TextStyle->{FontFamily->myfont, FontSize->myfontsize}
    , DefaultFont→{"Courier",20.}
          , LegendBorderSpace -> 0.2
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.77, +0.75}
          , LegendSize->{1.5, 0.10}
          , LegendTextOffset->{0.0, -1.00}
          , LegendLabel->lgnlbmod
          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
*)
    (*   , DisplayFunction->Identity  *)
(*    ]; *)
 ], "Graphics", CellTags->"Modulus"];
Display[FigName<>"Modulus"<>".eps", Graphics[pmod], "EPS"]
Get[commondir<>"000-p2_nb-m.m"]

colorstyle=colorstylepha;huebeg=huebegpha;
StylePrint[
ppha=  (* ------------------------------------------------------------- *)
ShowLegend[
    gfshowpha
    , Which[
          colorstyle===1
      (* , {Hue[0, #, #]&, 10, lgnup, lgndn *)
         , {Hue[1-(#)(1-huebeg)]&, 30, lgnup, lgndn
          , LegendBorderSpace -> 0.2
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.81, +lgnposy}
          , LegendSize->{1.7, 0.10}
          , LegendTextOffset->{0.0, -0.70}
          , LegendLabel->lgnlb
          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
          }
        , colorstyle===0
          , {GrayLevel[#]&, 30, lgnup, lgndn
          , LegendBorderSpace -> 0.2
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.81, +lgnposy}
          , LegendSize->{1.7, 0.10}
          , LegendTextOffset->{0.0, -0.70}
          , LegendLabel->lgnlb
          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
          }
        ]
    , ImageSize->{imagesizex,imagesizey}
    (*   , DisplayFunction->Identity  *)
(*    ]; *)
 ], "Graphics", CellTags->"Phase"];
Display[FigName<>"Phase"<>".eps", Graphics[ppha], "EPS"]
Get[commondir<>"000-p2_nb-m.m"]
```



```
StylePrint[
psig=  (* ------------------------------------------------------------- *)
ShowLegend[
    ListPlot[ wpsig
    , PlotJoined->True
    , PlotStyle->{Thickness[0.0008] (* , Hue[0.0] *) }
    , Frame->True
    , FrameLabel->
      If[ StringMatchQ[StringTake[noext, -1 ], "4"
          ] || StringMatchQ[StringTake[noext, -1 ], "2"]
        , { "Time (sec)",
            If[ StringMatchQ[StringTake[noext, -1 ], "4"]
              , "Displacement (cm)"
              , "Acqueous flow (cm/sec)" ]
          }
        , {xstr, ystr}  (*   {"X value",  " Y value"}  *)
      ]
    , AspectRatio->1/aspectratiox / (1+0.0)
    , PlotLabel->
      StyleForm[" "<>"["<>noext<>
                "] "<>gfdate,  FontFamily->myfont, FontSize->myfontsize
               ]
    , DisplayFunction->Identity
    ]
    ,
            {GrayLevel[0]&, 30, " ",  " "
          , LegendBorderSpace -> 0.8
          , LegendOrientation->Horizontal
          , LegendPosition->{-0.81, +lgnposy}
          , LegendSize->{1.7, 0.10}
          , LegendTextOffset->{0.0, -0.70}
(*
          , LegendPosition->{-0.77, +0.75}
          , LegendSize->{1.5, 0.10}
          , LegendTextOffset->{0.0, -1.00}
*)
          , LegendLabel->StyleForm["Signal"<>" (CPU="<>
             ToString[hrd]<>":"<>ToString[mind]<>":"<>
             ToString[secd]<>")",  FontFamily->myfont, FontSize->myfontsize+2
             ]

          , LegendLabelSpace->+2.65
          , LegendShadow->{0.01, 0.01}
          }
    , ImageSize->{imagesizex,imagesizey}
(*    ]; *)
 ], "Graphics", CellTags->"Signal"];
Display[FigName<>"Signal"<>".eps", Graphics[psig], "EPS"]

Get[commondir<>"000-p2_nb-m.m"]

StylePrint[
If[flag3dmod=!="no", {
pmod3d=  (* ------------------------------------------------------------- *)
ShowLegend[
     ListPlot3D[
         ampary
       , Mesh->False
       , BoxStyle->{ Dashing[{0.02, 0.01}]
```

```
                    , Thickness[0.0008]
                    }
       , AxesLabel->{ "Time (sec)", "Scale (~Hz)", " " }
       , AxesEdge->{ Automatic, Automatic, Automatic }
       , Ticks->{ xttab
                , yttab
                , Automatic
                }
       , PlotRange->All
(*       , AspectRatio->1/1.406 / (1+0.0)    *)
       , AspectRatio->1/aspectratiox / (1+0.0)
    (* , PlotLabel->StyleForm["~Modulus   "<>"["<>noext<>"] "<>gfdate,
                          FontFamily->myfont, FontSize->myfontsize+2 ]   *)
       , DisplayFunction->Identity
       , ViewPoint->{-1.469,-1.244,2.783}
       ]
       , {
          GrayLevel[1]&, 30, " ",  " "
         , LegendBorderSpace -> .8
         , LegendOrientation->Horizontal
         , LegendPosition->{-0.81, +lgnposy}
         , LegendSize->{1.7, 0.10}
         , LegendTextOffset->{0.0, -0.70}
(*
         , LegendPosition->{-0.87, +0.70}
         , LegendSize->{1.5, 0.1}
         , LegendTextOffset->{0.0, -1.00}
*)
         , LegendLabel->StyleForm["~Modulus   "<>"["<>wlet<>","<>
            nowfile<>" ("<>
            StringTake[ToString[N[saibeg+ 0.0001, 10]],4]<>","<>
            StringTake[ToString[N[saiend+ 0.0001, 10]],4]<>")"<>
            phaswitchflag<>"] "<>gfdate,
            FontFamily->myfont, FontSize->myfontsize ]
         , LegendLabelSpace->+2.5
         , LegendShadow->{0.01, 0.01}
         }
    , ImageSize->{imagesizex,imagesizey}
    (* , DisplayFunction->Identity  *)
    ] (* ; *)
    (*  ListPlot3D[1-wpamp, Mesh->False,ViewPoint->{-1.689,1.484,2.416}] *)
(* } ]; *)
} ], "Graphics", CellTags->"3DModulus"];
If[flag3dmod=!="no", {
   Display[FigName<>"Modulus-3D"<>".eps", Graphics[pmod3d], "EPS"]
  } ];

StylePrint[
If[flag3dpha=!="no", {
ppha3d=  (* ------------------------------------------------------------- *)
ShowLegend[
     ListPlot3D[
        phaary
       , Mesh->False
       , BoxStyle->{ Dashing[{0.02, 0.01}]
                   , Thickness[0.0008]
                   }
       , AxesLabel->{ "Time (sec)", "Scale (~Hz)", " " }
       , AxesEdge->{ Automatic, Automatic, Automatic }
       , Ticks->{ xttab
                , yttab
```



```
                , zttab (*  Automatic  *)
                }
(*       , AspectRatio->1/1.406 / (1+0.0)    *)
       , AspectRatio->1/aspectratiox / (1+0.0)
    (* , PlotLabel->StyleForm[" "<>"["<>noext<>"] "<>gfdate,
                          FontFamily->myfont, FontSize->myfontsize ] *)
       , ViewPoint->{-1.469,-1.244,2.783}
       , PlotRange->All
       , DisplayFunction->Identity
       ]
       , {
          GrayLevel[1]&, 30, " ",  " "
         , LegendBorderSpace -> .8
         , LegendOrientation->Horizontal
         , LegendPosition->{-0.81, +lgnposy}
         , LegendSize->{1.7, 0.10}
         , LegendTextOffset->{0.0, -0.70}
(*
         , LegendPosition->{-0.87, +0.70}
         , LegendSize->{1.5, 0.1}
         , LegendTextOffset->{0.0, -1.00}
*)
         , LegendLabel->StyleForm["Phase   "<>"["<>wlet<>","<>
            nowfile<>" ("<>
            StringTake[ToString[N[saibeg+ 0.0001, 10]],4]<>","<>
            StringTake[ToString[N[saiend+ 0.0001, 10]],4]<>")"<>
            phaswitchflag<>"] "<>gfdate,
            FontFamily->myfont, FontSize->myfontsize ]
         , LegendShadow->{0.01, 0.01}
         }
    , ImageSize->{imagesizex,imagesizey}
      (* , DisplayFunction->Identity  *)
    ] (* ; *)
(* } ]; *)
} ], "Graphics", CellTags->"3DPhase"];
(* Run["mmawav.bat"]; *)
If[flag3dpha=!="no", {
   Display[FigName<>"Phase-3D"<>".eps", Graphics[ppha3d], "EPS"]
  } ];
Get[commondir<>"000-p2_nb-m.m"]

Get[commondir<>"000-p3.m"]
On[General::spell1];On[General::spell];
(* ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ *)
(* Hyperlinks: Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End
```

(* Hyperlinks: Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End

(* Hyperlinks: Files Parameters Modulus Phase Signal 3 DModulus 3 DPhase End *)

(* A Quasi Wavelet Basis Function for Refined Ridge Extraction*)

(* by Ron Lee *)

ü Files and Parameters

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

```
<< "c:/lee/mat/Initial_SetNotebook.M" (* Set notebook options *)
<< "c:/lee/mat/Initial_Forms.M";
<< "c:/lee/mat/Initial_Frames.M";
<< "c:/lee/mat/Initial_Words.M";
FigDir = "G:\\Fig\\MMA\\WaveletVariantCharacterizations\\";
FigName = FigDir;
myfont = "Times";
$TextStyle = {FontFamily -> "Times", FontSize -> myfontsize};
timeflag = "Y";
dynamictimeflag = "N";
flabelflag = "Y";
flabelflag2 = "Y";
abcdflag = "N";
llabelflag = "y";
gridlineflag = "YY";
xyaxisflag = "LL";
stringposflag = 1 ;
xshiftflag = 0;
forcedstringaryflag = "n";
forcedflabelflag = "n" ;
stringindexmul = 3;
stringindexsin = 1;
abcdlabel = "a";
timeflag = "Y"; tlabel = tlabelv;
```

ü Macros

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

```
doshowxy := {
  moutt[flabel];
  moutt[flabel2];
  myplot=ListPlot[ dataxy
    , PlotJoined->True
    , PlotRange->All
    , PlotStyle->{Thickness[0.0008] (* , Hue[0.0] *) }
    , Frame->True
```



```
    , DisplayFunction->Identity
  ];
  (* myshow; *)
   Display[PigName<>EpsStrTmp<>".eps", Graphics[myshow], "EPS"];
  (* Run["wmawav.bat"]; *)
  <<"c:/lee/mat/000-p2_nb-m.m"
};
```

```
flabel2 := typestr<>"α="<>StringTake[ToString[N[scap1,
9]],If[StringLength[ToString[N[scap1, 9]]]>=7, 7, 1] ]<>", β="<>ToString[N[
peakshiftp1,2]]<>"π, ξ="<>StringTake[
ToString[N[xi,2]],1]<>", (0↔"<>StringTake[ToString[N[xlimitp1, 2]],1]<>"π),
θ="<>ToString[N[phap1,3]]<>"π";
```

ü Leakage Out

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

ü Leakage out (Wavelet variant)

```
(* -------- Frequency Leakage Out (Variant) --------- *)
typestr="Wavelet Variant: ";
xlabel="Scale";
ylabel="Projections at different wavelet scales";
flabel="Ambiguity Effects : Leakage OUT from a wave packet";
<<"c:/lee/mat/000-p1_nb-m.m";
frelkgout [peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
  1 / (scav) * NIntegrate[Cos[xiv*x]*Sin[xiv*x/scav]*
     Exp[-((x - peakshiftv/xiv)^2/scav^2 + (x)^2)/(2)],
     {x, 0, xlimitv}
  , MinRecursion->3, MaxRecursion->10
];
  (*  1 / scav * NIntegrate[Cos[x]*Sin[xiv * x/scav]*   (* a=sca/xi *)
       Exp[-((x/scav - peakshiftv/xiv )^2 + (x)^2)/(2)],
  *)
peakshiftp1=0.5;peakshift= peakshiftp1 * Pi;
xlimitp1=7;xlimit=xlimitp1 * Pi;
phap1=0;pha=phap1 * Pi;
xi=5;
scap1=1;
datax= Table[ ni , {ni, 0.025, 5, 0.025}];
datay= Table[ frelkgout [peakshift, sca, xlimit, pha, xi], {sca, 0.025 ,
5 , 0.025 } ];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="WV_LO";
doshowxy;
```

ü Leakage out (Morlet)

```
(* -------- Frequency Leakage Out (Morlet) ---------- *)
typestr="Morlet Wavelet: ";
xlabel="Scale";
ylabel="Projections at different wavelet scales";
flabel="Ambiguity Effects : Leakage OUT from a wave packet";
<<"c:/lee/mat/000-p1_nb-m.m";
(*
frelkginM[peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
   NIntegrate[Cos[u/scav]*Cos[(u)]*
     Exp[-((u - peakshiftv)^2+ (u/scav)^2)/(2*xiv^2)],
     {u, 0, xlimitv}
     , MinRecursion->3, MaxRecursion->10
];
*)
(*  There exists analytical form  *)
frelkgoutM [peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
  2*  1 / (scav) * Integrate[Cos[xiv*x]*Cos[xiv*x/scav]*
     Exp[-((x - peakshiftv/xiv)^2/scav^2 + (x)^2)/(2)],
     {x, 0, Infinity}
];
peakshiftp1=0;  peakshift= peakshiftp1 * Pi;
xlimitp1=7;  xlimit=xlimitp1 * Pi;
phap1=0;  pha=phap1 * Pi;
xi=5;
scap1=1;
dofrelkgoutM=frelkgoutM [peakshift, sca, xlimit, pha, xi](*analytical form*)

datax= Table[ ni , {ni, 0.000, 5, 0.025}];
datay= Table[ N[dofrelkgoutM], {sca, 0.000 , 5 , 0.025 } ];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="MW_LO";
doshowxy;
```

■ `<< "c:\\lee\\mat\\000-p1.m";`

$$\text{FindMinimum}\left[-1 * 1 / \text{sca} * \left(\left(E^{-\frac{25\,(-1+\text{sca})^2}{2\,(1+\text{sca}^2)}} + E^{-\frac{25\,(1+\text{sca})^2}{2\,(1+\text{sca}^2)}}\right)\sqrt{\frac{\pi}{2}}\,\sqrt{1+\frac{1}{\text{sca}^2}}\,\text{sca}^2\right) \Big/ (2\,(1+\text{sca}^2)),\ \{\text{sca},\ 0.97\}\right]$$

```
<< "c:/lee/mat/000-p2_nb-m.m"
```

ü **Leakage In** File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

ü Leakage in (Wavelet variant)

```
(* -------- Frequency Leakage In (Variant) -------- *)
typestr="Wavelet Variant: ";
xlabel="Scale";
ylabel="Projections from wave packets of different scales";
flabel="Ambiguity Effects : Leakage IN from different wave packets";
<<"c:/lee/mat/000-p1_nb-m.m";
frelkgin[peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
   NIntegrate[Cos[u/scav]*Sin[(u)]*
     Exp[-((u - peakshiftv)^2+ (u/scav)^2)/(2*xiv^2)],
     {u, 0, xlimitv}
     , MinRecursion->3, MaxRecursion->10
];
(* gsca[b_, a_, s_] := NIntegrate[Cos[u/a]*Sin[(u)]*
                  Exp[-((u-Pi/2.)^2.+(u/a)^2.)/(2*s^2)], {u, 0, b} ] *)
peakshiftp1=0.5;peakshift= peakshiftp1 * Pi;
xlimitp1=7;xlimit=xlimitp1 * Pi;
phap1=0;pha=phap1 * Pi;
xi=5;
scap1=1;
datax= Table[ ni , {ni, 0.025, 5, 0.025}];
datay= Table[ frelkgin [peakshift, sca, xlimit, pha, xi], {sca, 0.025 ,
5 , 0.025 } ];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="WV_LI";
doshowxy;
```

ü Leakage in (Morlet)

```
(* --------- Frequency Leakage In (Morlet) --------- *)
typestr="Morlet Wavelet: ";
xlabel="Scale";
ylabel="Projections from wave packets of different scales";
flabel="Ambiguity Effects : Leakage IN from different wave packets";
<<"c:/lee/mat/000-p1_nb-m.m";
(*  There exists closed analytical form  *)
frelkginM[peakshiftv_, scav_, xlimitv_, phav_, xiv_] :=
   2 * Integrate[Cos[u/scav]*Cos[(u)]*
     Exp[-((u - peakshiftv)^2+ (u/scav)^2)/(2*xiv^2)],
     {u, 0, Infinity}
];
peakshiftp1=0;  peakshift= peakshiftp1 * Pi;
xlimitp1=7;  xlimit=xlimitp1 * Pi;
phap1=0;  pha=phap1 * Pi;
xi=5;
scap1=1;
dofrelkginM=frelkginM [peakshift, sca, xlimit, pha, xi](*analytical form*)

datax= Table[ ni , {ni, 0.000, 5, 0.025}];
datay= Table[ N[dofrelkginM], {sca, 0.000 , 5 , 0.025 } ];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="MW_LI";
doshowxy;
```

```
<< "c:/lee/mat/000-p1_nb-m.m"

FindMinimum[
 -1 * 10 * ((E^(-25 (-1+sca)^2 / (2 (1+sca^2))) + E^(-25 (1+sca)^2 / (2 (1+sca^2)))) Sqrt[π/2] Sqrt[1 + 1/sca^2] sca^2) / (2 (1 + sca^2)), {sca, 1.01}]

<< "c:/lee/mat/000-p2_nb-m.m"
```

ü Phase noise

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

ü Phase noise (Wavelet variant)

```
(* -------------      Phase Noise       --------------- *)
typestr="Wavelet Variant: ";
xlabel="Phase";
ylabel="Projections from different phases";
flabel="Phase Noise : Related to differnet locations of a wave packet";
<<"c:/lee/mat/000-p1_nb-m.m";
integright[peakshiftv_, scaadjv_, xlimitv_, phav_, xiv_] :=
  NIntegrate[Cos[u/scaadjv-phav]*Sin[u]*
    Exp[-((u -peakshiftv )^2. + (u/scaadjv-phav)^2.)/(2*xiv^2)],
    {u, 0, xlimitv}
    , MinRecursion->3, MaxRecursion->10 ];
integleft[peakshiftv_, scaadjv_, xlimitv_, phav_, xiv_] :=
  NIntegrate[Cos[u/scaadjv-phav]*Sin[-u]*
    Exp[-((u + peakshiftv )^2. + (u/scaadjv-phav)^2.)/(2*xiv^2)],
    {u, -1.*xlimitv, 0}
    , MinRecursion->3, MaxRecursion->10 ];
peakshiftp1=0.5;  peakshift= peakshiftp1 * Pi;
xlimitp1=7;  xlimit=xlimitp1 * Pi;
phap1=0;  pha=phap1 * Pi;
xi=5;
scaadj= 0.9696215570582459 97;  scap1=scaadj;
phaintp1=Table[  integright[peakshift, scaadj, xlimit, phav, xi],
                 {phav, 0.05 Pi,  6.5  Pi , 0.05 Pi } ];
phaintp2=Table[  integleft[peakshift, scaadj, xlimit, phav, xi],
                 {phav, 0.05 Pi,  6.5  Pi , 0.05 Pi } ];
phaintmid=2 * Table[  integleft[peakshift, scaadj, xlimit, phav, xi],
                 {phav, 0.00 Pi,  0.00 Pi , 0.05 Pi } ];
posshiftsum=phaintp1+phaintp2;
midintsum=phaintmid;
datax=Join[ -1* Reverse[Table[ ni * Pi, {ni, 0.05, 6.5, 0.05}]], {0}, Table[ ni
* Pi, {ni, 0.05, 6.5, 0.05}] ];
datay=Join[ Reverse[posshiftsum], midintsum, posshiftsum];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="WV_PN";
doshowxy;
```


ü Phase noise (Morlet)

```
(* ---------      Phase Noise (Morlet)      ---------- *)
typestr="Morlet Wavelet: ";
xlabel="Phase";
ylabel="Projections from different phases";
flabel="Phase Noise : Related to differnet locations of a wave packet";
<<"c:/lee/mat/000-p1_nb-m.m";
integrightM[peakshiftv_, scaadjv_, xlimitv_, phav_, xiv_] :=
  NIntegrate[Cos[u/scaadjv-phav]*Cos[u]*
    Exp[-((u -peakshiftv )^2. + (u/scaadjv-phav)^2.)/(2*xiv^2)],
    {u, 0, xlimitv}
    , MinRecursion->3, MaxRecursion->10 ];
integleftM[peakshiftv_, scaadjv_, xlimitv_, phav_, xiv_] :=
  NIntegrate[Cos[u/scaadjv-phav]*Cos[-u]*
    Exp[-((u + peakshiftv )^2. + (u/scaadjv-phav)^2.)/(2*xiv^2)],
    {u, -1.*xlimitv, 0}
    , MinRecursion->3, MaxRecursion->10 ];
peakshiftp1=0.0;  peakshift= peakshiftp1 * Pi;
xlimitp1=7;  xlimit=xlimitp1 * Pi;
phap1=0;  pha=phap1 * Pi;
xi=5;
scaadj= 1;
scap1=scaadj;
phaintp1=Table[  integrightM[peakshift, scaadj, xlimit, phav, xi],
                 {phav, 0.05 Pi,  6.50 Pi , 0.05 Pi } ];
phaintp2=Table[  integleftM[peakshift, scaadj, xlimit, phav, xi],
                 {phav, 0.05 Pi,  6.50 Pi , 0.05 Pi } ];
phaintmid=2 * Table[  integleftM[peakshift, scaadj, xlimit, phav, xi],
                 {phav, 0.00 Pi,  0.00 Pi , 0.05 Pi } ];
posshiftsum=phaintp1+phaintp2;
midintsum=phaintmid;
datax=Join[ -1* Reverse[Table[ ni * Pi, {ni, 0.05, 6.50, 0.05}]], {0}, Table[ ni
* Pi, {ni, 0.05, 6.50, 0.05}] ];
datay=Join[ Reverse[posshiftsum], phaintmid, posshiftsum];
dataxy=Table[ {datax[[ i ]], datay[[i]]}, {i,1 ,Length[datax]}];
EpsStrTmp="MW_PN";
doshowxy;
```

ü Roots

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

```
<< "c:/lee/mat/000-p1_nb-m.m"
g[b_, a_, s_] := Integrate[Cos[u/a]*Sin[(u)]*
      Exp[-((u - Pi/2.)^2.+u^2.)/(2*s^2)], {u, 0, b}]
FindRoot[g[5.*Pi, a, 5] == 0, {a, 0.95, 0.7, 1.2}]
<< "c:/lee/mat/000-p2_nb-m.m"
```

```
<< "c:/lee/mat/000-p1_nb-m.m"
g[b_, a_, s_] := Integrate[Cos[u/a]*Sin[(u)]*
      Exp[-((u - Pi/2.)^2.+u^2.)/(2*s^2)], {u, 0, b}]
FindRoot[g[7.*Pi, a, 5] == 0, {a, 0.9696, 0.7, 1.2}]
<< "c:/lee/mat/000-p2_nb-m.m"
```

```
<< "c:/lee/mat/000-p1_nb-m.m"
g[b_, a_, s_] := Integrate[Cos[u / a] * Sin[(u)] *
       Exp[-((u - Pi / 2.) ^2. + (u / a) ^2.) / (2 * s^2)], {u, 0, b}]
FindRoot[g[5. * Pi, a, 5] == 0, {a, 0.97, 0.7, 1.2}]
<< "c:/lee/mat/000-p2_nb-m.m"
(* Run["mmawav.bat"]; *)
```

ü **Others** File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

ü Close form integrations

$$g2(b\_, a\_, s\_) = \int_0^{\infty} \cos\left(\frac{u}{a}\right) \sin(u)\, e^{-\frac{\left(\frac{u}{a}\right)^2 \cdot + u^2 \cdot}{2 s^2}}\, du$$

```
<< "c:/lee/mat/000-p1_nb-m.m"
g2[b_, a_, s_] = Integrate[Cos[u / a] * Sin[(u)] *
       Exp[-((u) ^2. + (u / a) ^2.) / (2 * s^2)], {u, 0, Infinity}]
<< "c:/lee/mat/000-p2_nb-m.m"
```

```
<< "c:/lee/mat/000-p1_nb-m.m"
g3[b_, a_, s_] = Integrate[Cos[u / a] * Sin[(u)] *
       Exp[-((u - Pi / 2.) ^2. + (u / a) ^2.) / (2 * s^2)], {u, 0, Infinity}]
<< "c:/lee/mat/000-p2_nb-m.m"
```

```
<< "c:/lee/mat/000-p1_nb-m.m"
g4[a_, s_] := NIntegrate[Cos[u / a] * Sin[(u)] *
       Exp[-((u - Pi / 2.) ^2. + (u / a) ^2.) / (2 * s^2)], {u, 0, Infinity}]
g4[0.969621557058245997, 5]
<< "c:/lee/mat/000-p2_nb-m.m"
```

File | Macro | LeakOut | LeakIn | PhaseNoise | Root | Others | End

■ Appendix

附錄三：　眾多工作平台程式之一例

一個類似一鍵「雲端儲存」多元彈性化之安全備份程式 —
此程式始撰於 Windows 2000 年代，
是時「雲端」觀念幾乎未爲所知，
而 SATA 介面尚未導入，另硬碟主流最大容量尚僅在 40 GB。

```
// Assign("ComboFromPC","%@('ComputerName');");
// Assign("ComboToPC","%$('NetComputerName');");
Beep(0, "%b\Sound\MUI.wav");
Assign("MUIRadioButton2","");
Assign("FromPCGiven","將指定_To be specified");// 將給定指定
Assign("ToPCGiven","%$('FromPCGiven');");
    // ------------------------------------- ■
Assign("ToDriveGiven","%$('FromPCGiven');");
// ------------------------------------------------------------
Assign("ComboToRootDirFlag","1");
Assign("ToRootDirGiven","%$('FromPCGiven');");
Assign("ActionTypeSpecial", "No");
// // ------------------------------------- ■
// Assign("DestinationRootDir1","Backup");
// IfIStr("%$('ActionExe');", "xcopy", "=", >
//    !|>
//      Assign("DestinationRootDir", "- No -");>
//     |,!|>
//      Assign("DestinationRootDir", "- %$('DestinationRootDir1');\
   ?_Disk\ - (?: source drive)");>
//     |);
// ------------------------------------------------------------
Assign("UseBtnStr", "Use RadioButton next time");
Assign("UseBoxStr", "Use ComboBox next time");
// // Default: UseBoxStr
// IfIStr("%$('UIFlag');", "%$('UseBtnStr');", "=", >
//    !| >
//      Assign("UIFlag", "%$('UseBtnStr');");>
//      Assign("UIAltFlag", "%$('UseBoxStr');");>
//     |,!|>
//      Assign("UIFlag", "%$('UseBoxStr');");>
//      Assign("UIAltFlag", "%$('UseBtnStr');");>
//     |);
// Default: UseBtnStr
IfIStr("%$('UIFlag');", "%$('UseBoxStr');", "=", >
   !| >
     Assign("UIFlag", "%$('UseBoxStr');");>
     Assign("UIAltFlag", "%$('UseBtnStr');");>
    |,!|>
     Assign("UIFlag", "%$('UseBtnStr');");>
     Assign("UIAltFlag", "%$('UseBoxStr');");>
    |);
// ============================================================
Assign("ScriptFlag","N");
IfIStr("%!0", "S", "=", !|Assign("ScriptFlag","Y");|,!|Relax;|);
IfIStr("%!0", "P", "=", !|Assign("ScriptFlag","Y");|,!|Relax;|);
// ============================================================
IfIStr("%$('ActionExe');", "xcopy", "=", >
   !|>
     IfIStr("%$('ScriptFlag');", "Y", "=", >
         !‘ >
          // Assign("ComboToPC","%@('ComputerName');"); >
          Assign("ComboFromPCFlag","1");>
          Assign("ComboToPCFlag","1");>
          Assign("ComboFromDriveFlag","10");>
          // Assign("ComboToDriveFlag","15");>
          Assign("ComboToDriveFlag","%$('BackupDriveNo');");>
          Assign("SourceTypeIndex","0"); >
          Assign("ScopeRangeIndex","1");>
          Assign("ActionTypeSpecialIndex","1"); >
         ‘,‘ >
          // Assign("ComboToPC","%@('NetComputerName');"); >
          Assign("ComboFromPCFlag","1");>
          Assign("ComboToPCFlag","2");>
          Assign("ComboFromDriveFlag","1");>
          // Assign("ComboToDriveFlag","%$('BackupDriveNo');");>
          Assign("ComboToDriveFlag","1");>
          Assign("SourceTypeIndex","1"); >
          Assign("ScopeRangeIndex","3");>
          Assign("ActionTypeSpecialIndex","1"); >
         ‘);>
    |,!|>
     IfIStr("%$('ScriptFlag');", "Y", "=", >
         !‘ >
          // Assign("ComboToPC","%@('ComputerName');"); >
          Assign("ComboFromPCFlag","1");>
          Assign("ComboToPCFlag","1");>
          Assign("ComboFromDriveFlag","10");>
          // Assign("ComboToDriveFlag","15");>
          Assign("ComboToDriveFlag","%$('BackupDriveNo');");>
          Assign("SourceTypeIndex","0"); >
          Assign("ScopeRangeIndex","1");>
          Assign("ActionTypeSpecialIndex","1"); >
         ‘,‘ >
          // Assign("ComboToPC","%$('NetComputerName');"); >
          Assign("ComboFromPCFlag","1");>
          Assign("ComboToPCFlag","1");>
          Assign("ComboFromDriveFlag","1");>
          // Assign("ComboToDriveFlag","14");>
          Assign("ComboToDriveFlag","%$('BackupDriveNo');");>
          // Prompt("%@('ComboToDriveFlag');");>
          Assign("SourceTypeIndex","1"); >
          Assign("ScopeRangeIndex","3");>
          Assign("ActionTypeSpecialIndex","1"); >
         ‘);>
    |);

// Assign("CheckNewer",    "Update !");  //Add_U/Del_Syn
// Assign("CheckNewer",    "One way Update !");
Assign("CheckNewer",    "Update only files that are newer (unchecking
   this will overwrite all files new and old!!)");
// Assign("CheckNewer",    "Two way Update !");
Assign("CheckSubDir",   "Include sub-Dirs"); // Subdirectories
Assign("CheckConfirm", "Confirmation");
Assign("CheckVerbose", "Enable MSG");
Assign("CheckNewerFlag","1");
Assign("CheckSubDirFlag","1");
Assign("CheckConfirmFlag","0");
Assign("CheckVerboseFlag","1");
```

```
IfIStr("%$('ActionExe');", "explorer", "=", >
   !|>
     Assign("ComboFromPCFlag","1");>
     Assign("ComboToPCFlag","1");>
     Assign("ComboFromDriveFlag","1");>
     Assign("ComboToDriveFlag","1");>
     Assign("SourceTypeIndex","1"); >
     Assign("ScopeRangeIndex","3");>
     //
     Assign("CheckNewer",   "---");>
     Assign("CheckSubDir",  "---");>
     Assign("CheckConfirm", "---");>
     Assign("CheckVerbose", "---");>
     Assign("CheckNewerFlag","0");>
     Assign("CheckSubDirFlag","0");>
     Assign("CheckConfirmFlag","0");>
     Assign("CheckVerboseFlag","0");>
    |,!|>
     Relax;>
    |);
// ================================================================
// ================================================================
// ----------------------------------------------------------------
Exe("%b\edt\GetMotherDir.edt");
// ================================================================
OpenOutput("%b\MUI\RXZ-ANYWHERE.mui", 0);
// WrL(‘MUITitle("勇伯保全 e 網搞
   定_%$('ActionExe'); anywhere (Rar, Xcopy, Zip, Explore)");‘);
WrL(‘MUITitle("勇伯保全 e 網打
   盡_%$('ActionExe'); anywhere (Rar, Xcopy, Zip, Explore)");‘);
WrL(‘MUIWidth(640);‘);
// ================================================================
// WrL(‘MUITab("%$('ActionExe'); Main");‘);
// ================================================================
// ----------------------------------------------------------------
// Prompt("%$('ScriptFlag'); - %$('SourceTypeIndex');");
IfIStr("%$('UIFlag');", "%$('UseBtnStr');", "=", >
     // ======================================== ■
   !‘ >
// // RadioBotton index starts from 1
// LetRegNum(9, "%$('SourceTypeIndex'); + 1");>
// Assign("SourceTypeIndex", "%!9");>
WrL(‘‘MUIRadioButton("">
// (D): This Dir|(X): This Ext|(F): This File|(.): ..\%$('ThisDir');|>
(D): This Dir _ %$('ThisDir');\*.*|>
(.): Mother Dir _ ..%$('UpThisDir');\*.*|>
(X): This Extension _ *.%$('ThisExt');|>
(F): This File _ %N%T|>
(S): Script list _ ZipOrRarDirList-Routine.dat|>
(P): Script list _ Project Dirs (ZipOrRarDirList-Project.dat)|>
(A): All-Asy|>
(O): All-Words|>
(T): All-Tex|>
(L): %b|(W): %B|(E): Outlook>
```



```
// (P): Project|(M): Main Dir>
",>
// RadioBotton index starts from 1
%$('SourceTypeIndex');>
// %!9>
,">
%$('ActionExe'); 保全對象類型_Source Type:  [(D)%p,  (X)*.%$('ThisExt');)]>
");‘‘);>
// ---------------------------------------- ■
// // RadioBotton index starts from 1
// LetRegNum(9, "%$('SourceTypeIndex'); + 1");>
// Assign("SourceTypeIndex", "%!9");>
// WrL(‘‘MUIRadioButton("">
// (S): Script list|>
// // (D): This Dir|(X): This Ext|(F): This File|(.): ..\%$('ThisDir');|
   >
// (D): %$('ThisDir');\*.*|(.): ..%$('UpThisDir');\%$('ThisDir');|(X):
   *.%$('ThisExt');|(F): %N%T|>
// (A): All-Asy|(O): All-Words|(T): All-Tex|>
// (L): %b|(W): %B|(E): Outlook>
// // (P): Project|(M): Main Dir>
// ",>
// // RadioBotton index starts from 1
// %$('SourceTypeIndex');>
// // %!9>
// ,">
// %$('ActionExe'); 保全對象類
   型_Source Type:  [(D)%p,  (X)*.%$('ThisExt');)]>
// ");‘‘);>
// // ---------------------------------------- ■
WrL(‘‘MUILabelComboBox("">
User Interface Style for SOURCE TYPE - effective next time:>
", ">
// Same (Use RadioButton)|>
Same (%$('UIFlag');)|>
%$('UIAltFlag');>
",>
1>
);‘‘);>
// // ---------------------------------------- ■
// WrL(‘‘MUILabel("">
// User Interface Style for Type - effective next time:>
// ");‘‘);>
// WrL(‘‘MUIComboBox("">
// Same (Use RadioButton)|>
// %$('UIAltFlag');>
// ",>
// 1>
// );‘‘);>
     // ======================================== ■
    ‘,!‘>
// ---------------------------------------- ■
WrL(‘‘MUILabel("">
%$('ActionExe'); 保全對象類型_SOURCE TYPE:  [(D)%p,  (X)*.%$('ThisExt');)]>
");‘‘);>
```

```
WrL(‘‘MUIComboBox("><
// (D): This Dir|(X): This Ext|(F): This File|(.): ..\%$(’ThisDir’);|><
// (D): This Dir - %$(’ThisDir’);\*.*|><
// (.): Mother Dir - ..%$(’UpThisDir’);[\%$(’ThisDir’);]|><
(D): This Directory - %p\*.*|>
(X): This Extension - *.%$(’ThisExt’);|>
(F): This File - %N%T|>
(.): Mother Directory - ..%$(’MotherDir’);[\%$(’ThisDir’);]|>
(P): Script list _ Project Dirs (ZipOrRarDirList-Project.dat)|>
(S): Script list _ Routine ZipOrRarDirList-Routine.dat (Batch is
   recommended)|>
(L): TeX Cfg - %b|>
(A): All-Asy (Per, All-Asy, Fig))|>
(O): All-Words|>
(T): All-Tex (*.tex, texo, ctex, ctexo)|>
(W): WinEdt System - %B|>
(E): Outlook - %@(’USERPROFILE’);\Local Settings\Application Data\
   Microsoft\Outlook>
",>
%$(*SourceTypeIndex*);>
‘‘);>
// ---------------------------------------- ■
WrL(‘‘MUIRadioButton("><
%$(’UIAltFlag’);>
",>
O>
,"><
// User-Interface for SOURCE TYPE next time (default: ComboBox): >
User Interface Style for SOURCE TYPE - effective next time:>
");‘‘);>
     // ======================================= ■
   ‘);
// ------------------------------------------------------------------
WrL(‘MUILabel("><
From PC:>
");‘);
WrL(‘MUIComboBox("><
// %@(’ComputerName’);|%$(’NetComputerName’);|%$(’NetComputerName2’);|>
%@(’ComputerName’);|%$(’NetComputerName’);|%$(’NetComputerName1’);|%$(’
   NetComputerName2’);|%$(’NetComputerName3’);|%$(’NetComputerName4’);|
   %$(’NetComputerName5’);|%$(’NetComputerName6’);|%$(’NetComputerName7
   ’);|%$(’NetComputerName8’);|>
%$(*FromPCGiven*);>
", %$(*ComboFromPCFlag*););‘);
WrL(‘MUILabel("><
Source Drive: >
// (Script type 時可選擇存有備份的硬碟)>
(When in SCRIPT TYPE you can select the drive where backup files exist)>
// (Script type時可選擇其它已存有備份的硬碟)>
// (Script type時可選擇已存在之備份硬碟)>
");‘);
WrL(‘MUIComboBox("><
// A:|C:|D:|E:|F:|G:|H:|I:|J:|K:|L:|M:|N:|O:|P:|Q:|R:|S:|T:|U:|V:|W:|X:|
   Y:|Z:|%$(’ComboFromToDriveDefined’);>
// %$(’ComboFromToDriveDefined’);|A:|C:|D:|E:|F:|G:|H:|I:|J:|K:|L:|M:|N
```



```
   :|X:|Y:|Z:>
%$(’ComboFromToDriveDefined’);|A:|B:|C:|D:|E:|F:|G:|H:|I:|J:|K:|L:|Z:|>
", %$(*ComboFromDriveFlag*););‘);
WrL(’MUIRadioButton("><
// (P)artial_list|(F)ull_list>
(F) Full_list (When RAR, -M is appended; For AUTO SCRIPT RAR - no
   appendix)>
// ",%$(‘ScopeRangeIndex‘);,"Scope: (For Script Type only, Default to
   Partial list)");’);
// ",%$(‘ScopeRangeIndex‘);,"Scope for Script Type:  (Default to Partial
    list, Better to use AUTO)");’);
",%$(‘ScopeRangeIndex‘);,"Scope when in SCRIPT TYPE (default to
   Partial_list): (When RAR, -M is appended)");’);
// ",%$(‘ScopeRangeIndex‘);,"Scope for SCRIPT TYPE:  (Otherwise default
   to Partial list, *-M created, Better to use AUTO)");’);
WrL(‘MUILabel("><
To PC:>
");‘);
WrL(‘MUIComboBox("><
// %@(’ComputerName’);|%$(’NetComputerName’);|%$(’NetComputerName2’);|>
%@(’ComputerName’);|%$(’NetComputerName’);|%$(’NetComputerName1’);|%$(’
   NetComputerName2’);|%$(’NetComputerName3’);|%$(’NetComputerName4’);|
   %$(’NetComputerName5’);|%$(’NetComputerName6’);|%$(’NetComputerName7
   ’);|%$(’NetComputerName8’);|>
%$(*ToPCGiven*);>
", %$(*ComboToPCFlag*););‘);
WrL(‘MUILabel("><
Destination Drive:>
");‘);
WrL(‘MUIComboBox("><
// A:|C:|D:|E:|F:|G:|H:|I:|J:|K:|L:|M:|N:|O:|%$(’ComboFromToDriveDefined
   ’);>
%$(’ComboFromToDriveDefined’);|A:|B:|C:|D:|E:|F:|G:|H:|I:|J:|K:|L:|M:|N
   :|Z:|>
%$(*ToDriveGiven*);>
", %$(*ComboToDriveFlag*););‘);
WrL(‘MUILabel("><
Additional Destination Root Dir:>
");‘);
WrL(‘MUIComboBox("><
%$(’DestinationRootDir’);|>
%$(*ToRootDirGiven*);>
", %$(*ComboToRootDirFlag*););‘);
// ================================================================
// WrL(‘MUITab("Options and Special");‘);
// ================================================================
// ----------------------------------------------------------------
WrL(‘MUICheckBox("><
%$(’CheckNewer’);>
", %$(’CheckNewerFlag’););‘);
WrL(‘MUICheckBox("><
%$(’CheckSubDir’);>
", %$(’CheckSubDirFlag’););‘);
WrL(‘MUICheckBox("><
%$(’CheckConfirm’);>
```

```
", %$('CheckConfirmFlag'););`);                                          306
WrL(`MUICheckBox(">
%$('CheckVerbose');>
", %$('CheckVerboseFlag'););`);
// ------------------------------------------------------------------
WrL(`MUILabel(">                                                        311
%$('ActionExe');  Special (Effective for xcopy only)>
");`);
WrL(`MUIComboBox(">
(No): No special (As prescribed above - One way update to new)|>
(TW): Two ways TO and FROM|>                                            316
(ST): Sync TO (Remove dirs and xcopy!)|>
(SF): Sync FROM (Remove dirs and xcopy!)|>
",>
%$(*ActionTypeSpecialIndex*);>
);>                                                                     321
`);>
// ------------------------------------------------------------------
CloseOutput;
WinExe("",`%B\Plugins\MUI\mui.exe "%b\MUI\RXZ-ANYWHERE.mui"`,"%b\MUI","
    My MUI",000100);
// ==================================================================  326
IfIStr("%$('MUIOK');", "0", "=", "Exit;", ""); >
// ==================================================================
IfIStr("%$('UIFlag');", "%$('UseBtnStr');", "=", >
   !| >
     FindInString("%$(`MUIRadioButton1`);", "(", 1, 1, 0, 0);>          331
     LetRegNum(1, "%!1+1");>
     ExtractByIndex(2, "%$(`MUIRadioButton1`);", %!1, %!1);>
     LetReg(0, "%!2");>
    |,!|>
     FindInString("%$(`MUIComboBox1`);", "(", 1, 1, 0, 0);>             336
     LetRegNum(1, "%!1+1");>
     ExtractByIndex(2, "%$(`MUIComboBox1`);", %!1, %!1);>
     LetReg(0, "%!2");>
    |);
// ==================================================================  341
// Prompt("%$('UIFlag');--%$('UIAltFlag');");
IfIStr("%$('UIFlag');", "%$('UseBtnStr');", "=", >
   !` >
     // Prompt("%$('MUIComboBox1');--%$('UIFlag');--%$('UIAltFlag');");>
     IfIStr("%$('MUIComboBox1');", "%$('UIAltFlag');", "=", >           346
        !| >
          Assign("UIFlag", "%$('UIAltFlag');");>
         |,!|>
         |);>
    `,!`>                                                               351
     IfIStr("%$('MUIRadioButton1');", "%$('UIAltFlag');", "=", >
        !| >
          Assign("UIFlag", "%$('UIAltFlag');");>
         |,!|>
         |);>                                                           356
    `);
// ==================================================================
// ---------------------------------------- ■
```



```
IfIStr("%$('ComboFromPCFlag');", "1", "=",!`LetReg(1,"%$('ComputerName')
   ;");`,!``);
IfIStr("%$('ComboFromPCFlag');", "2", "=",!`LetReg(1,"%$('                361
   NetComputerName');");`,!``);
IfIStr("%$('MUIComboBox2');", "%$('FromPCGiven');", "=", >
   !` >
     EnterReg(1,"%!1", "Source PC Name: (%$('ActionExe');)");>
     Assign("ComboFromPC","%!1");>
    `,!`>                                                               366
     Assign("ComboFromPC","%$('MUIComboBox2');");>
    `);
// ---------------------------------------- ■
IfIStr("%$('MUIComboBox3');", "%$('ComboFromToDriveDefined');", "=", >
   !` >                                                                 371
//       Assign("ComboFromDrive","%$('MUIComboBox3');");>
//       Assign("ComboToDrive","%$('ComboFromDrive');");>
     Assign("ComboFromDrive","%$('ComboFromToDriveDefined');");>
    `,!`>
     ExtractByIndex(2, "%$('MUIComboBox3');", 0, 0); >                  376
     Assign("ComboFromDrive","%!2");>
     // LetReg(3, "%!2");>
    `);
// Prompt("%$('ComboFromDrive');|%!3");
// ---------------------------------------- ■                           381
IfIStr("%$(`MUIRadioButton2`);", "", "=",>
    |>
     Assign("FlagEnd","EndPart");>
    |,>
    |>                                                                  386
    |);
FindInString("%$(`MUIRadioButton2`);", "(", 1, 1, 0, 0);
LetRegNum(1, "%!1+1");
ExtractByIndex(2, "%$(`MUIRadioButton2`);", %!1, %!1);
// Prompt("%!2");                                                       391
IfIStr("%!2", "F", "=",>
    |>
     Assign("FlagEnd","End");>
    |,>
    |>                                                                  396
     Assign("FlagEnd","EndPart");>
    |);
// ---------------------------------------- ■
IfIStr("%$('ComboToPCFlag');", "1", "=",!`LetReg(1,"%$('ComputerName')
   ;");`,!``);
IfIStr("%$('ComboToPCFlag');", "2", "=",!`LetReg(1,"%$('NetComputerName   401
   ');");`,!``);
IfIStr("%$('MUIComboBox4');", "%$('ToPCGiven');", "=", >
   !` >
     EnterReg(1,"%!1", "Destination PC Name: (%$('ActionExe');)");>
     Assign("ComboToPC","%!1");>
    `,!`>                                                               406
     Assign("ComboToPC","%$('MUIComboBox4');");>
    `);
// ---------------------------------------- ■
IfIStr("%$('MUIComboBox5');", "%$('ComboFromToDriveDefined');", "=", >
```

```
   !‘ >
     Assign("ComboToDrive","%$(’ComboFromToDriveDefined’);");>
    ‘,!‘>
     IfIStr("%$(’MUIComboBox5’);", "%$(’ToDriveGiven’);", "=", >
        !* >
          // LetReg(1,"Z:");>
          // IfIStr("%$(’ComboToDriveFlag’);", "10", "=", !"LetReg(1,’I
             :’);",!"LetReg(1,’Z:’);");>
          // IfIStr("%$(’ComboToDriveFlag’);", "14", "=", !"LetReg(1,’%$
             (’BackupDrive’);’);",!"LetReg(1,’Z:’);");>
          LetReg(1,’%$(’BackupDrive’);’);>
          EnterReg(1,"%!1", "Destination Drive: (%$(’ActionExe’);)");>
          ExtractByIndex(1, "%!1", 0, 0); >
          Assign("ComboToDrive","%!1");>
         *,!*>
          ExtractByIndex(2, "%$(’MUIComboBox5’);", 0, 0); >
          Assign("ComboToDrive","%!2");>
         *);>
    ‘);
// // ---------------------------------------- ■
// IfIStr("%$(’MUIComboBox5’);", "%$(’ComboFromToDriveDefined’);", "=",
   >
//    !‘ >
//      Assign("ComboToDrive","%$(’ComboFromToDriveDefined’);");>
//     ‘,!‘>
//      IfIStr("%$(’MUIComboBox5’);", "%$(’ToDriveGiven’);", "=", >
//         !* >
//           // LetReg(1,"Z:");>
//           IfIStr("%$(’ComboToDriveFlag’);", "10", "=", !"LetReg(1,’I
   :’);",!"LetReg(1,’Z:’);");>
//           // IfIStr("%$(’ComboToDriveFlag’);", "10", "=", !"LetReg(1,
   ’%$(’BackupDrive’);’);",!"LetReg(1,’Z:’);");>
//           EnterReg(1,"%!1", "Destination Drive: (%$(’ActionExe’);)");
   >
//           ExtractByIndex(1, "%!1", 0, 0); >
//           Assign("ComboToDrive","%!1");>
//          *,!*>
//           ExtractByIndex(2, "%$(’MUIComboBox5’);", 0, 0); >
//           Assign("ComboToDrive","%!2");>
//          *);>
//     ‘);
// ---------------------------------------- ■
IfIStr("%$(’MUIComboBox6’);", "%$(’ToRootDirGiven’);", "=", >
   !* >
     LetReg(1,"%$(’DestinationRootDir1’);\?_Disk\");>
     EnterReg(1,"%!1", "Destination Root Dir: (%$(’DestinationRootDir1’)
        ;\?_Disk\)");>
     Assign("DestinationRootDir","%!1");>
     // Prompt("Y");>
    *,!*>
     // Prompt("N");>
     Relax;>
    *);
// // ====================================================================
// FindInString("%$(‘MUIRadioButton3‘);", "(", 1, 1, 0, 0);
```



```
// LetRegNum(1, "%!1+1");
// ExtractByIndex(2, "%$(‘MUIRadioButton3‘);", %!1, %!1);
// LetReg(9,"%!2:");
// IfIStr("%!9", "D:", "=",>
//      |>
//       EnterReg(9, "Drive:", "Destination Drive"); >
//      |,>
//      |>
//       Relax; >
//      |);
// // ---------------------------------------- ■
// FindInString("%$(‘MUIRadioButton4‘);", "(", 1, 1, 0, 0);
// LetRegNum(1, "%!1+1");
// ExtractByIndex(2, "%$(‘MUIRadioButton4‘);", %!1, %!1);
// // LetReg(9,"%!2:");
// IfIStr("%!2", "D", "=",>
//      |>
//       EnterReg(2, "PC:", "Destination PC"); >
//      |,>
//      |>
//       Relax; >
//      |);
// // ====================================================================
// // --------------------------------------------------------------------
// IfIStr("%$(’MUICheckBox1’);", "%$(’CheckNewer’);", "=",>
//      !‘ >
//       IfIStr("%$(’ActionExe’);", "xcopy", "=", "Assign(’CheckNewer’,
   ’/D’);", ""); >
//       IfIStr("%$(’ActionExe’);", "rar", "=", "Assign(’CheckNewer’, ’a
   -u     ’);", ""); >
//       IfIStr("%$(’ActionExe’);", "zip", "=", "Assign(’CheckNewer’, ’-
   whs -u -P’);", ""); >
//      ‘,‘ >
//       IfIStr("%$(’ActionExe’);", "xcopy", "=", "Assign(’CheckNewer’, ’
     ’);", ""); >
//       IfIStr("%$(’ActionExe’);", "rar", "=", "Assign(’CheckNewer’, ’a
   -u -as’);", ""); >
//       IfIStr("%$(’ActionExe’);", "zip", "=", "Assign(’CheckNewer’, ’-
   whs     -P’);", ""); >
//      ‘);
// Prompt("q:%$(’MUICheckBox2’);  a:%$(’CheckNewer’);  b:%$(*CheckSubDir
   *);  c:%$(’CheckConfirm’);");
// IfIStr("%$(’MUICheckBox2’);", "%$(’CheckSubDir’);", "=",>
//      !‘ >
//       IfIStr("%$(’ActionExe’);", "xcopy", "=", "Assign(’CheckSubDir’,
   ’/E’);", ""); >
//       IfIStr("%$(’ActionExe’);", "rar", "=", "Assign(’CheckSubDir’, ’-
   r’);", ""); >
//       IfIStr("%$(’ActionExe’);", "zip", "=", "Assign(’CheckSubDir’, ’-
   r’);", ""); >
//      ‘,‘ >
//       IfIStr("%$(’ActionExe’);", "xcopy", "=", "Assign(’CheckSubDir’,
   ’  ’);", ""); >
//       IfIStr("%$(’ActionExe’);", "rar", "=", "Assign(’CheckSubDir’, ’
    ’);", ""); >
```

```
//      IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckSubDir', '
    ');", ""); >
//      Assign("NoSubDir","-NoSubDir");>
//     ');
// Prompt("01:%$(*CheckSubDir*);");
//                                                                    506
// IfIStr("%$('MUICheckBox3');", "%$('CheckConfirm');", "=",>
//    !' >
//      IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckConfirm',
    '/-Y');", ""); >
//      IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckConfirm',
    '');", ""); >
//      IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckConfirm',    511
    '');", ""); >
//     ',' >
//      IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckConfirm',
    '/Y ');", ""); >
//      IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckConfirm',
    '');", ""); >
//      IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckConfirm',
    '');", ""); >
//     ');                                                            516
// IfIStr("%$('MUICheckBox4');", "%$('CheckVerbose');", "=",>
//    !' >
//      IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckVerbose',
    '  ');", ""); >
//      IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckVerbose', '
    ');", ""); >
//      IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckVerbose', '  521
    ');", ""); >
//     ',' >
//      IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckVerbose',
    '/q');", ""); >
//      IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckVerbose',
    '-inul');", ""); >
//      IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckVerbose',
    '-ybc');", ""); >
//     ');                                                            526
// ===============================================================
// ---------------------------------------------------------------
// IfIStr("%$('MUICheckBox1');", "%$('CheckNewer');", "=",>
IfIStr("%$('MUICheckBox1');", "1", "=",>
   !' >                                                               531
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckNewer', '/D
        ');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckNewer', 'a -u
         ');", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckNewer', '-whs
        -u -P');", ""); >
    ',' >
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckNewer', '    536
        ');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckNewer', 'a -u
        -as');", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckNewer', '-whs
```



```
         -P');", ""); >
    ');
// IfIStr("%$('MUICheckBox2');", "%$('CheckSubDir');", "=",>
IfIStr("%$('MUICheckBox2');", "1", "=",>                               541
   !' >
     // IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckSubDir',
        '/E');", ""); >
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckSubDir', '/i
         /s /e /k /r /h');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckSubDir', '-r')
        ;", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckSubDir', '-r')  546
        ;", ""); >
    ',' >
     // IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckSubDir',
        '  ');", ""); >
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckSubDir', '/i
           /k /r /h');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckSubDir', '  ')
        ;", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckSubDir', '  ')  551
        ;", ""); >
     Assign("NoSubDir","-NoSubDir");>
    ');

// IfIStr("%$('MUICheckBox3');", "%$('CheckConfirm');", "=",>
IfIStr("%$('MUICheckBox3');", "1", "=",>                               556
   !' >
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckConfirm',
        '/-Y');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckConfirm', '')
        ;", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckConfirm', '')
        ;", ""); >
    ',' >                                                              561
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckConfirm', '/
        Y ');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckConfirm', '')
        ;", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckConfirm', '')
        ;", ""); >
    ');
// IfIStr("%$('MUICheckBox4');", "%$('CheckVerbose');", "=",>             566
IfIStr("%$('MUICheckBox4');", "1", "=",>
   !' >
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckVerbose', '
        ');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckVerbose', '
         ');", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckVerbose', '    571
        ');", ""); >
    ',' >
     IfIStr("%$('ActionExe');", "xcopy", "=", "Assign('CheckVerbose', '/
        q');", ""); >
     IfIStr("%$('ActionExe');", "rar", "=", "Assign('CheckVerbose', '-
```

```
        inul');", ""); >
     IfIStr("%$('ActionExe');", "zip", "=", "Assign('CheckVerbose', '-
        ybc');", ""); >
    ');
// ===============================================================
FindInString("%$('MUIComboBox7');", "(", 1, 1, 0, 0);
LetRegNum(1, "%!1+1");
ExtractByIndex(2, "%$('MUIComboBox7');", %!1, %!1+1);
Assign("ActionTypeSpecial", "%!2");
// Prompt("%$('ActionTypeSpecial');");
// ===============================================================
// ===============================================================
IfIStr("%$('PromptFlag');", "M", "=", >
    ' >
     IfIStr("%!0", "S", "=",>
          ' >
           Open("%b\doc\ZipOrRarDirList-Routine.dat");>
          ',' >
           Relax;>
          '); >
    ',' >
     Relax; >
    ');
IfIStr("%$('PromptFlag');", "M", "=", >
    ' >
     IfIStr("%!0", "P", "=",>
          ' >
           Open("%b\doc\ZipOrRarDirList-Project.dat");>
          ',' >
           Relax;>
          '); >
    ',' >
     Relax; >
    ');
// ===============================================================
Assign('CheckNewerMSG', 'Add and Update');
Assign('CheckSubDirMSG', 'Yes');
Assign('CheckConfirmMSG', 'No');
Assign('CheckVerboseMSG', 'Yes');
IfIStr("%$('ActionExe');", "rar", "=", >
   !|>
     IfIStr("%$('CheckNewer');", "a -u -as", "=", "Assign('CheckNewerMSG
        ', 'Delete and Sync');", ""); >
     IfIStr("%$('CheckSubDir');", "  ", "=", "Assign('CheckSubDirMSG', '
        No');", ""); >
     IfIStr("%$('CheckVerbose');", "-inul", "=", "Assign('
        CheckVerboseMSG', 'No');", ""); >
    |,!|>
    |);
IfIStr("%$('ActionExe');", "zip", "=", >
   !|>
     IfIStr("%$('CheckNewer');", "-whs    -P", "=", "Assign('
        CheckNewerMSG', 'Delete and Sync');", ""); >
     IfIStr("%$('CheckSubDir');", "  ", "=", "Assign('CheckSubDirMSG', '
        No');", ""); >
```



```
     IfIStr("%$('CheckVerbose');", "-ybc", "=", "Assign('CheckVerboseMSG
        ', 'No');", ""); >
    |,!|>
    |);
IfIStr("%$('ActionExe');", "xcopy", "=", >
   !|>
     IfIStr("%$('CheckNewer');", "  ", "=", "Assign('CheckNewerMSG', '
        Delete and Sync');", ""); >
     // IfIStr("%$('CheckSubDir');", "  ", "=", "Assign('CheckSubDirMSG'
        , 'No');", ""); >
     IfIStr("%$('CheckSubDir');", "/i       /k /r /h", "=", "Assign('
        CheckSubDirMSG', 'No');", ""); >
     IfIStr("%$('CheckConfirm');", "/-Y", "=", "Assign('CheckConfirmMSG'
        , 'Yes');", ""); >
     IfIStr("%$('CheckVerbose');", "/q", "=", "Assign('CheckVerboseMSG',
         'No');", ""); >
    |,!|>
    |);
// ===============================================================
IfIStr("%$(*ActionExe*);", "xcopy", "=", >
    !'>
      IfIStr("%$(*PromptFlag*);", "A", "=", >
         !' >
           Relax;>
          ',!'>
           Assign("TmpStr", |%$(*ComboToPC*);|);>
           Exe("%b\edt\RXZ-Anywhere-EntTmpStr-Xcopy.edt");>
           Assign("ComboToPC", |%$(*TmpStr*);|);>
          ');>
     ',!'>
      Relax;>
     ');

//            Prompt(">
//            %$('ComboFromDrive'); %\>
//            ");>

// Prompt("a:%$('CheckNewer');  b:%$(*CheckSubDir*);  c:%$('CheckConfirm
   ');  d:%$('CheckVerbose');");

End;
```

附錄四：　簡 報 資 料



The Optimizations of Water Wave Time-Frequency Analyses (4/4) – Asyst Recipes for Water Wave Data Acquisition and Analyses

A basic research of IHMT

水波時頻分析之優化（4／4）－Asyst 程式集

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港灣技術研究中心
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Contents

1. Main Languages: Asyst, Mathematica, Winedt, etc
2. Scope of modalities:
   - Wavelet transform – discrete and continuous transforms; wavelet packet transforms; wavelet blowups; entropy statistics; norm distributions; best basis for water waves; phase of characteristic function; wavelet coherences; adapted time-frequency windows; wavelet variant and characterizations; etc
   - Hilbert transform – analytic signal; instantaneous frequency; etc
   - Fourier transform – spectral coherences; correlations
   - etc
3. Real-time lab system for data acquisition
4. Workbench Development
5. Data and document processing and management system

Wavelet bases tested

- Orthonormal (ON) [4, 1, 5, 7, 8]
  - Daubechies' most symmetric (ONxxS)
  - Daubechies' most asymmetric (ONxxA)
  - Coiflets (ONxxC)
  - Meyer wavelet
  - Battle-Lemarié (B&L)
- Semi-orthogonal (SO) [1, 2]
  - Mother wavelet (SOxO)
  - Dual wavelet (SOxD)
- Bi-orthogonal (BO) [5]
  - Mother wavelet (BOxyO)
  - Dual wavelet (SOxyD)
- Wavelet Packet basis [3, 1, 5, 9, 10]
  - All ON groups (single or mixed) (WP best basis & WP best level)

Comparison of reconstructed signals

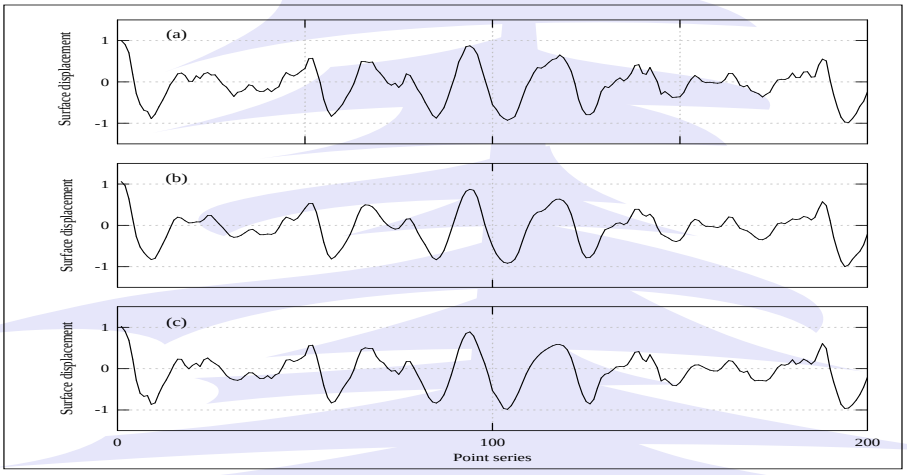


Figure 17: Comparison of reconstructed signals using truncated spectral coefficients and semi-orthogonal wavelet coefficients. Here 35% of the coefficients are kept. The original signal is shown in (a), signal reconstructed from spectral coefficients in (b), and that from SO3D wavelet coefficients in (c). The semi-orthogonal wavelet is seen to better portrait the original signal, especially the small scale transient features.

Cumulative pdf curves of various transforms (II)

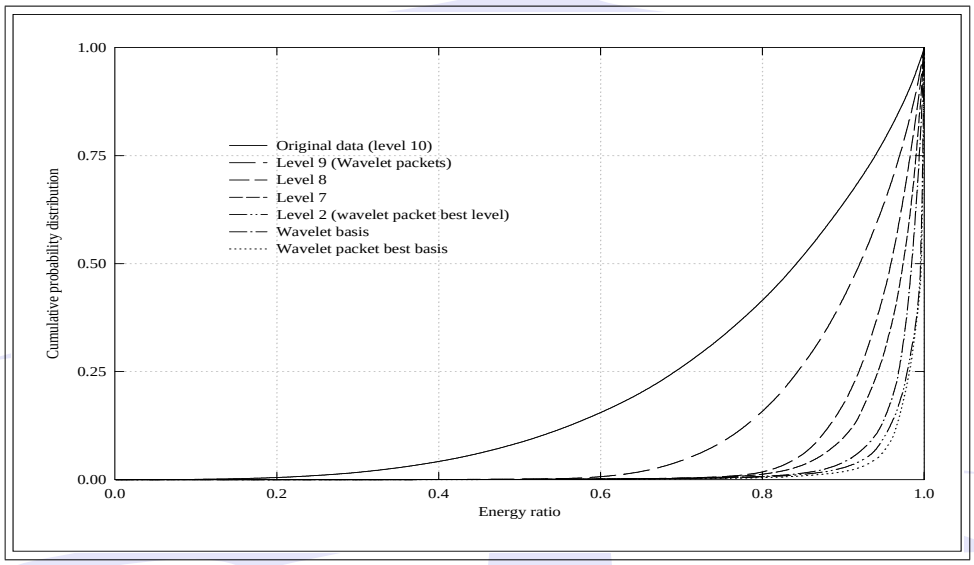


Figure 19: The cumulative probability distribution curves of the sorted wavelet and wavelet packet coefficients (L^2-norm squared, i.e., energy content) for various bases which all originate from a single mother wavelet. These bases include those of various wavelet packet levels, wavelet packet best basis, as well as the seeding wavelet basis ON77S; as are indicated in the legend.

The frequency leakage-in distribution curves

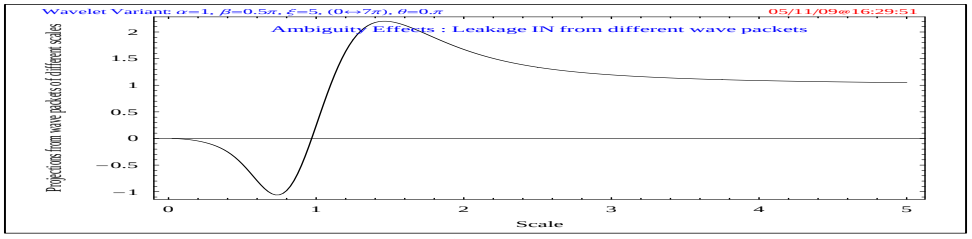


Figure 31: The frequency leakage-in distribution curve for the proposed basis function. The frequency leakage-in is the projection of a non-unit scale basis function into the unit scale basis function. It shows consistent results with the frequency leakage-out. Here the parameter value is the same as that of the previous figures.

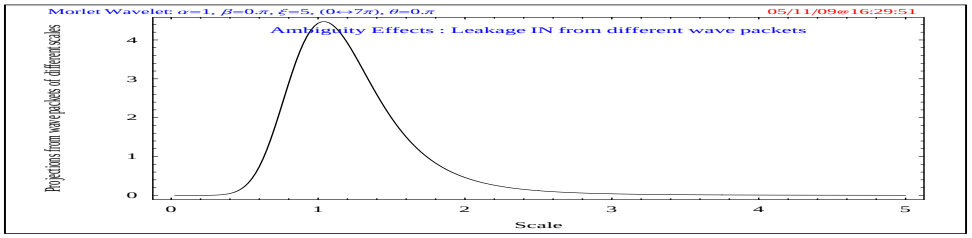


Figure 32: The frequency leakage-in distribution curve for the simplified Morlet wavelet. The frequency leakage-in is the projection of a non-unit scale wavelet function into the unit scale wavelet function. It shows consistent results with those of frequency leakage-out.

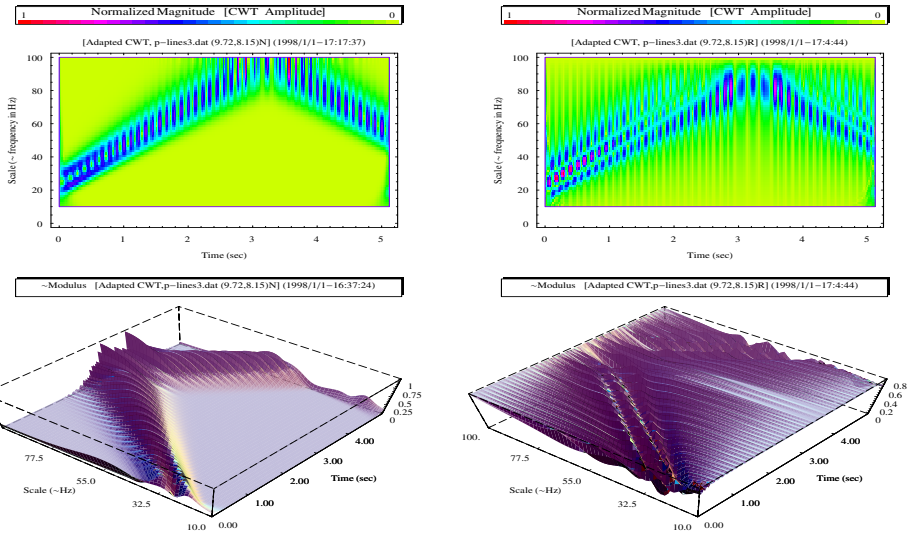


Figure 43: This figure shows the ridge extraction of a signal composed of a pair of parallel chirps that are with equal power contents. Here the frequency separation between the two chirps is one tenth Nyquist rate. The left sub-figures are for the simplified Morlet wavelet, and the right sub-figures are for the quasi wavelet basis function. It is clear that he power ridge given by the simplified Morlet wavelet is entirely misleading. But, for the quasi wavelet basis function, the two interfacial lines are clearly identifiable except at region near the Nyquist frequency. In the bottom right sub-figure, we have intentionally inverted the rendering, i.e., a trough in the 2-D plane (top right sub-figure) turns to a peak in the 3-D figure; and what are seen are the two clear spike lines.

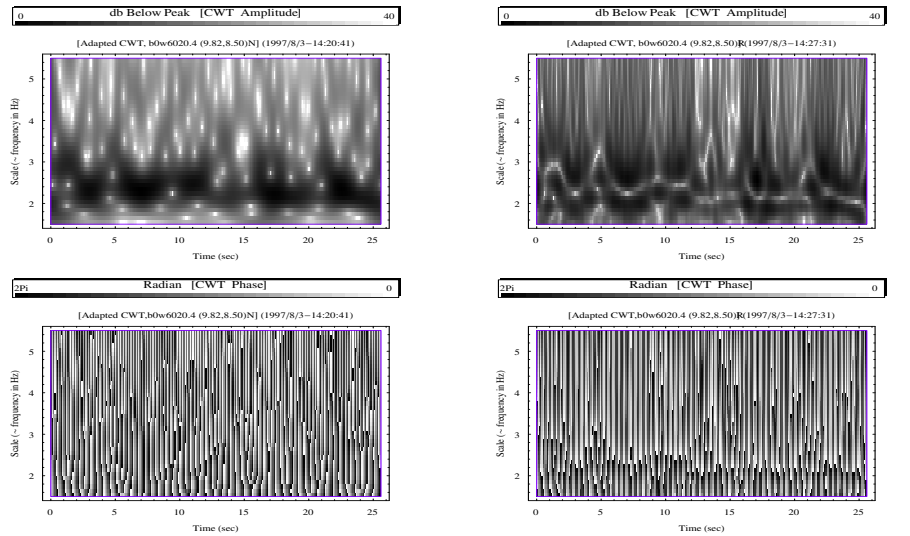


Figure 46: This figure show the modulus and phase renditions of a water wave signal measured in a wind blowing laboratory tank. The left sub-figures use the simplified Morlet wavelet, and right sub-figures use the proposed basis function. In general the latter ones provide easy and precise identification of the energy ridge, in particular, its phase plane rendition shows relatively outstanding features.

WC and SC (between wave and current) for three data lengthes

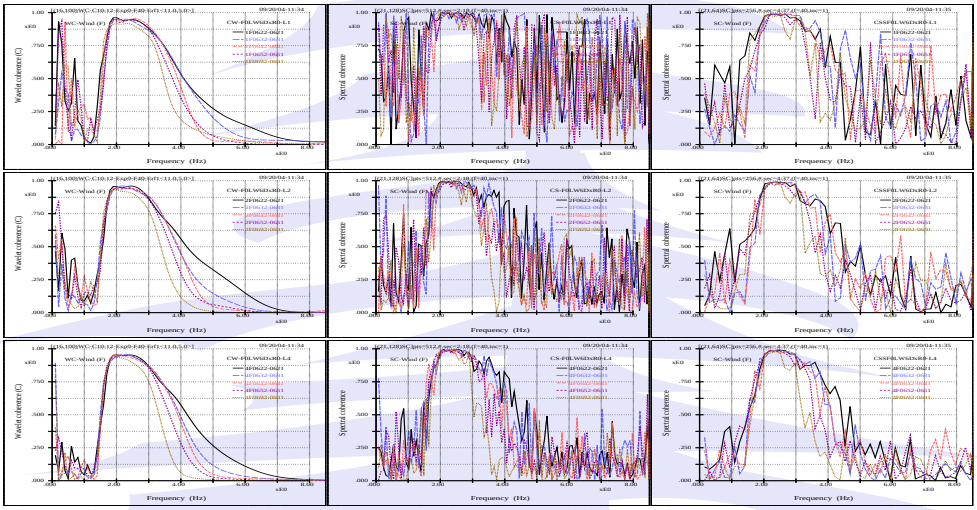


Figure 50: Wavelet coherences (left column) and Fourier spectral coherences (right two columna) between wave and current using three different data lengthes 1024 (top)、2048 (middle)、4096 (bottom). The flow is measured respectively at the depth of 2、3、4、5、9 cm below the still water surface.

Frequency aliasing and base band conversions

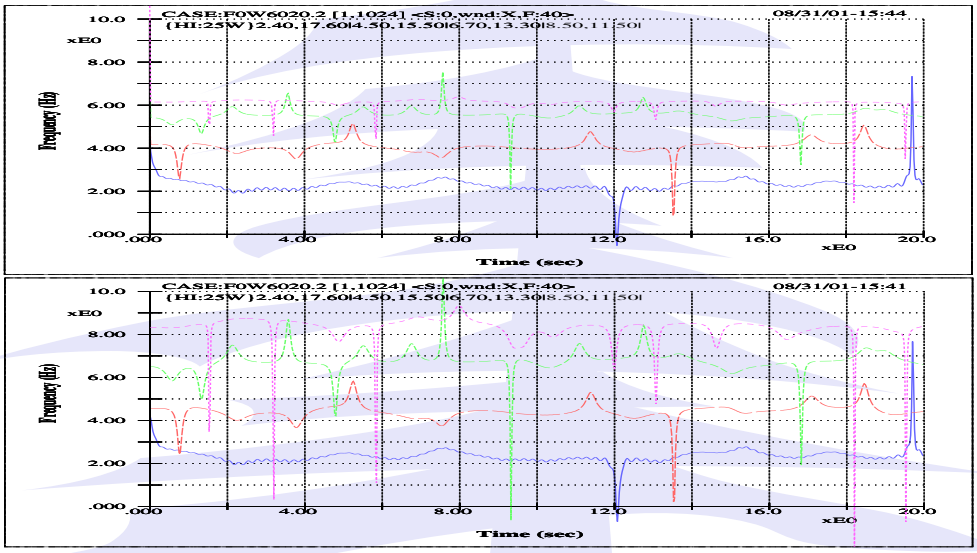


Figure 64: Frequency modulation curves without (top) and with (bottom) individual base band conversions. Without a base band conversion there is a frequency aliasing into the lower frequency region. And the aliasing downshifts of the center (or averaged) frequencies are ever more significant for higher frequency bands.

Workbench (4)

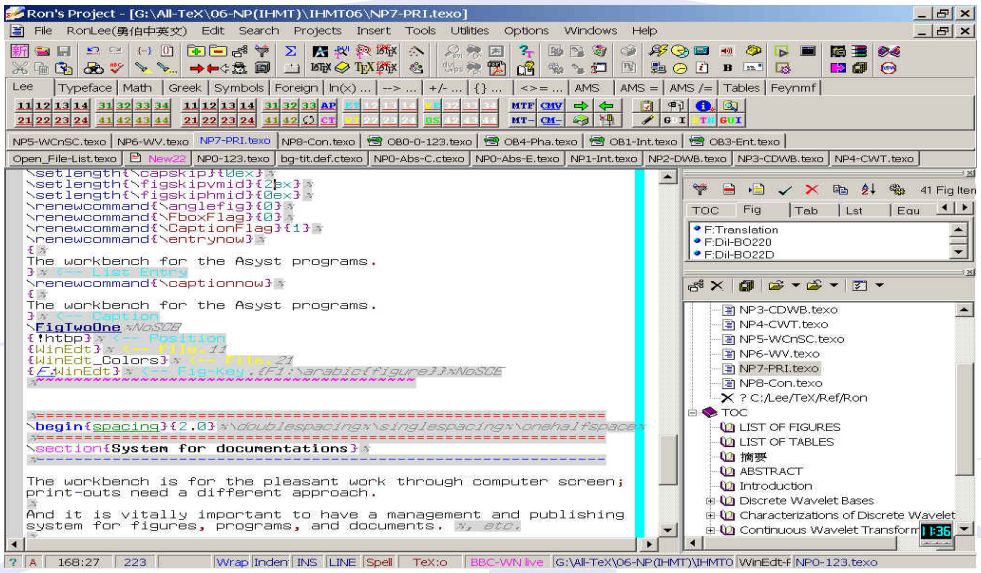


Figure 71: Some aspects of the workbench for the Asyst programs.

Conclusions

1. Numerical programming in Asyst, Mathematica, as well as other languages
2. The identification of the optimal wavelet basis for water wave modelings
3. Covering comprehensive wavelet basis categories
4. Based upon versatile criteria of simulation entropy
5. Furnishing various practical and analytical aspects of optimizations
6. Characterizations of wavelet and Fourier coherences, instantaneous frequency and Hilbert transform, etc
7. Workbench development for an integrated programming system

附錄五：　審 查 意 見 回 覆 表

交通部運輸研究所港灣技術研究中心

自辦研究計畫期末審查意見回覆表

水波時頻分析之優化（4／4）－

Asyst 與 Mathematica 程式集

審查委員及審查意見	意見回覆
梁乃匡委員：	
1. 本文對仔波分析有深入分析與探討，並用 Asyst 語言完成工作平台，可應用在水波資料分析，有學術和應用價值。	這一方向是歷來甚多委員所重視的。而理論之實際應用，始終是作者的研究初衷，也是作者對多年來在時頻分析探討所費心力進一步昇華的企盼，亦且是於公於私該盡、聊盡之責。另一方面，由基本研究以迄實際應用的歷程往往需經由試驗之精確掌控及釐定，特別是高階物理訊息之探討。作者於多年前，曾爲這些方向，規劃並編列較大型且偏重於試驗驗証之四年度長期研究計劃，計劃及經費均經各部、會、院審核通過執行，國科會列案。不料幾乎所有預算均遭本中心主任及本前科長在本人未知下挪用一空，遂行不學無術、拉關係、搞利益輸送之意圖。其敗壞官箴、斲喪學術研究之風氣，實無以爲甚。而各相關層級公務機關之怠惰也不堪與聞。

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張金機委員：	
1. 目前波浪數值模擬套裝軟體處處可得，但使用者眞正了解內涵的很少，大都從事操作應用。因此，對計算結果無法深入探討，信賴度也無法掌控。本研究從波浪理論解析，程算撰寫、計算，深入探討波浪演化，是從事波浪研究最重要，也是最艱難的一環。能埋首從事本研究需有極大毅力、耐力，值得肯定。	生命有限、程式無窮。記憶總是短暫，回顧、檢視、修改這些過往程式，作者也經常感到訝異，甚或驚奇，亦不免刻骨銘心，嗟歎光陰荏苒，卻也似箭如梭，時不我與。此處程式碼的結集所希冀的是：確立研究之可驗証性，追求科學上的客觀嚴謹，庶幾爲眞理奉上一些心力，並達本責。 再者書面與電子檔有其個別不可取代的功能與象徵。捨了紙筆，一切好像都是虛幻、不眞切，也似失了靈魂、丟了根，煙消雲滅可能一瞬間。
2. 本研究屬於純理論研究，在應用上是否可利用研究經驗協助現場觀測資料及試驗室量測資料篩選，以確保品質可信度。	本研究有應用在一些試驗資料。而正如答覆梁老師部分，尚未使用於現場資料。另熟悉此處分析理論對資料品質可信度及立論應大有助益。

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蔡清標委員：	
1. 本報告主要以Asyst 及Mathemctica 等程試語言，建構水波數據處理分析程式，並提供一個 open access 的程式集，立意甚佳。	此處程式碼的開發，是希望能爲各種訊號分析學理帶來一些更深入的領悟與驗証，也是作者當初爲規劃進一步試驗及應用的動力來源。可惜正如答覆梁老師中所言，環境已然敗壞。
2. 建議於各章節學理說明時，順便簡要說明應用程式之結構及使用，以及該程式應用時需注意之事項。	在各相關章節末尾應有一些條列，其順序一般即程式之結構。另亦注意儘可能不要遺漏任何子程式，即此處 Asyst 及 Mathemctica 程式集具有完整性。
3. 可否以附錄三之例，舉一使用範例，說明程式輸出之圖形結果。	已加入其輸出介面圖示，如圖 9.6。若使用機定選項就只要一直按 Return 鍵，並具有多元、彈性、安全、個人化、省時省空間、等機制。

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蕭士俊委員：	
1. 文中對各種參數有相當詳盡之探討（如 P19. 縮尺效應），對實際資料應用上如何選擇？有何建議？	數學源於定義，一點也不含糊，物理基於解說，可解說依人而論。解說之所以成立、其理得以接受之，必然是人們主、客觀所認定。數學不需單位，但物理均有其質，此處避免使用數學非物理量來解說物理，而各種參數選擇需要研究者對理論與數值處理能融匯貫通，基本上這些參數選擇並未有一致法則，因而需視個別狀況而定，這一方面研究者的功力是爲關鍵。
2. 優化之意義爲何？	理論上與程式上，本研究相關優化之主要意義如：（1）不同訊號或不同研究方向應選用個別適當函基、（2）在同一或各類屬函基中應選取得最佳者、（3）改變函基性狀增强其物理性、（4）調適數學參數使之加强模擬、（5）選擇適當離散計算策略降減離散計算副作用、（6）離散計算數值參數該如何選擇、（7）避免使用非物理量來解說物理、（8）資料處理完全自動化人性化、（9）圖表記載詳實精確無誤不可張冠李戴、等等。