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交通運輸研究所

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短期交通量變化混沌特性之探索與預測

Testing and Prediction for Chaotic Short-term Traffic

Flow Dynamics

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中華民國九十三年六月

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ABSTRACT

This research attempts to test for the presence of low-dimensional chaotic structure and to make predictions for traffic flow time series data. In order to test for chaos phenomena, we undertake a comprehensive comparison of promising plots and statistics between the observed freeway traffic flow data and their surrogates. The most crucial indexes are selected to develop the parsimony procedure. We also utilize some well-known time series data generators to validate the proposed procedure and further apply it to test for the chaoticity of traffic flows at different sites. Our results have shown strong evidence of chaoticity, rather than stochasticity, existent in the nature of freeway short-term (minute) traffic dynamics. In addition, this research develops three prediction models to forecast the chaotic traffic flow time-series data. The temporal confined (TC) model employs temporal similarity of flow trajectories to perform the prediction reasoning. The spatiotemporal confined (STC) model incorporates both spatial and temporal similarities into the prediction reasoning. The spatial confined (SC) model considers the spatial similarity to perform the reasoning. It is found that the three proposed models have demonstrated high prediction accuracy in capturing the short-term traffic flow dynamics.

Keywords: chaos, prediction models, short-term traffic dynamics, time series data, surrogate data

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