

基于解耦子波和优化神经网络的大坝变形预测

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摘要 针对提高神经网络对大坝变形的预测能力, 在对Murtagh提出的、小波与神经网络相结合的、用于复杂时间序列预测的“三阶段”策略进行改进的基础上, 发展了一个解耦子波和优化神经网络优势联合的预测模型。首先, 利用冗余Haar小波变换的拟小波包特性提出了基于能量谱主峰重构的动力解耦空间构建技术, 并将其替代“三阶段”策略中的第1阶段, 从而为神经网络的应用创建了良好的平台; 再者, 利用最优脑外科医生进行网络结构修剪, 建立了神经网络自身优化的“优化-时新窗”技术, 并将其替代“三阶段”策略中的第2阶段, 从而优化了神经网络的内部环境。改进后的模型增强了对复杂动力系统的适应和处理能力。在大坝变形预测应用中, 多个评价指标说明, 该模型的性能比“三阶段”策略有显著提高。

关键词 [水利工程](#); [动力解耦](#); [神经网络优化](#); [预测模型](#); [冗余Haar小波变换](#); [最优脑外科医生技术](#)

分类号

NEW PREDICTION MODEL FOR DAM DEFORMATION BASED ON DECOUPLED WAVELET AND OPTIMAL NEURAL NETWORKS

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Abstract

The three-stage strategy, proposed by Murtagh, for complicated time series prediction with wavelet and neural networks is improved. Based on the improved strategy, a new prediction model of decoupled wavelet and optimal neural network is proposed to increase the ability of neural networks for dam deformation

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prediction. Firstly, a new space reconstruction technique based on the main peak reconstruction of energy spectrum of original data is developed using the quasi-wavelet-packet property of redundant Haar wavelet; and then, it is used to substitute for the first stage of the three-stage strategy to built a better neural networks operating platform. Secondly, the optimal-refreshing window technique for neural network self-optimization is developed by using the optimal brain surgeon technique to prune the networks coefficients, and the inner condition of the neural network is optimized by substituting it for the second stage of the three-stage strategy. The adaptability and the analyzing ability of the newly reformed model are increased for the prediction of complicated dynamic system. It is proved by many evaluating indices such as relative mean square error, cross-relation, normal mean square error and direction symmetry in a case of predicting dam deformation that its function is significantly improved as compared with that of the three-stage strategy.

Key words [hydraulic engineering](#); [uncoupled dynamic space](#); [neural network optimization](#); [prediction model](#); [redundant Haar wavelet transform](#); [optimal brain surgeon technique](#)

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