

边坡非线性位移的神经网络 - 时间序列分析

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摘要 边坡的变形表现出复杂的非线性演化特征, 大量的工程实践表明利用部分实测的边坡位移时间序列来预测未来边坡的位移更为准确。以神经网络和时间序列分析方法为基础, 使用零均值化和标准偏差预处理方法, 以及规则化能量函数法和贝叶斯规则化方法进行BP神经网络建模, 利用BP网络对边坡位移非平稳时序进行趋势项提取, 使非平稳监测时序转化为平稳时序以进行常规ARMA时序分析。结合滚动预测方法, 建立了适合岩土体位移预测的神经网络 - 时间序列分析联合模型, 以隔河岩水电站进水口边坡变形和水布垭水电站大岩淌滑坡位移为例进行预测分析。研究表明: 新模型的预测精度高、实时可靠, 可应用于实际工程。

关键词 [岩土力学; 人工神经网络; 时间序列; 边坡; 位移; 预测](#)

分类号

RESEARCH ON ARTIFICIAL NEURAL NETWORK-TIME SERIES ANALYSIS OF SLOPE NONLINEAR DISPLACEMENT

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Abstract

As an explicit behavior of the complicated dynamic system, the displacements of slope are characterized with randomness and indetermination involving many uncertain factors; and the physical-based modeling is very difficult to fulfill prediction function. As an alternative, it was proved by many practical engineering cases that a set of displacement time series to predict the future displacement can be used. Based on the principles of artificial neural network and time series analysis, the BP network is established by zero mean method, standard deviation preprocess, regularization energy function, and Bayes-regularization to extract the trend term of displacement time series. After the extraction, the displacement time series becomes a balance series, which could be processed by normal ARMA model. In addition, combined with the real-time tracing algorithm, the artificial neural network-time series analysis(united modeling)for nonlinear displacement in geotechnical engineering was proposed. As a test, this modeling was used in displacement prediction of Geheyan Hydraulic Power Station intake slope and Dayantang slope in Shuibuya Hydraulic Power Station project. The results of engineering case indicate that it is reliable with high precision. It is proved that this modeling can be used to practical engineering.

Key words [rock and soil mechanics; artificial neural network; time series; slope; displacement; prediction](#)

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