

# 位移反分析的APSO-WNN模型研究及应用

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收稿日期 2006-8-26 修回日期 2006-10-30 网络版发布日期 2007-6-19 接受日期 2006-8-26

**摘要** 用改进粒子群优化算法对小波神经网络进行优化, 从而提出改进粒子群算法优化小波神经网络模型(APSO-WNN)。该模型具有小波变换的良好时频局域化性质、良好时域和频域分辨能力及传统神经网络的自学习功能; 同时用改进的粒子群优化法进行全局最优搜索, 快速收敛到全局最优解, 使其具有良好的逼近能力、容错能力和较强的鲁棒性。因此, 该计算模型适合解决具有复杂非线性和模糊性特点的岩土工程问题。为证明该模型的优越性, 同时将该计算模型与传统遗传算法神经网络用于三峡船闸高边坡4种介质弹性模量的位移反分析计算, 结果表明不论是优化精度还是收敛时间, 该算法都较遗传算法有明显提高。最后利用APSO-WNN反演的弹性模量参数进行测点位移预测, 预测表明各个测点的计算位移值与监测值吻合较好, 说明该模型在岩土工程位移反分析中具有有良好的实际应用价值。

**关键词** [岩石力学](#); [位移反分析](#); [小波神经网络](#); [粒子群算法](#); [弹性模量](#); [三峡工程](#)

分类号

## WAVELET NEURAL NETWORK BASED ON ADAPTIVE PARTICLE SWARM OPTIMIZATION AND ITS APPLICATION TO DISPLACEMENT BACK ANALYSIS

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### Abstract

The model of wavelet neural network(WNN) is optimized by using adaptive particle swarm optimization (APSO), which is named as wavelet neural network based on adaptive particle swarm optimization(APSO-WNN). The optimized model combines good time domain, frequency domain, and good resolving power of the wavelet transform, self-study of traditional neural network, and quick convergence to the optimum solution of the adaptive particle swarm optimization. Therefore, it has the advantages of great efficiency and good fault-tolerance and robustness, which makes it easy to solve the geotechnical engineering problem with characteristic of fuzziness and nonlinearity. For comparison, the models of APSO-WNN and GA-ANN(artificial neural network optimized by genetic algorithm) are used to calculate the elastic modulus of the high slope of the Three Gorges Project on the basis of the measured displacements. The result shows that the former model takes smaller time compared with GA-ANN in a same precision level. Those show that

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APSO-WNN model is an excellent model. At last, the calculated elastic modulus is used to forecast the displacements of the monitoring points of high slope of the Three Gorges Project. Forecasting values are in good agreement with the measured values, which indicate that the APSO-WNN model can be well applied to the displacement back analysis in geotechnical engineering.

**Key words** [rock mechanics](#); [displacement back analysis](#); [wavelet neural network](#); [particle swarm optimization](#); [elastic modulus](#); [Three Gorges Project](#)

DOI:

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