基于HGA-ANN驱动边坡稳定评价T-S型模糊推理系统

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摘要　　边坡工程的分析评价会因人脑在思维判断上存在的模糊性，而导致整个分析和设计过程带有一定的模糊不确定性。因此，边坡工程实际上是一个动态的、模糊的、开放的复杂非线性系统，传统的分析方法有时难以对复杂边坡的稳定性做出符合实际的评价。模糊方法和人工神经网络(ANN)都已分别用于边坡稳定性评价中，此2种方法具有很多优点，但也存在各自的局限性。采用人工神经网络(ANN)模型构建T-S型模糊推理系统，利用混合遗传算法(HGA)训练ANN模型，得到了基于混合遗传算法人工神经网络驱动的T-S型模糊推理系统模型，探讨了该模型在边坡稳定性评价中的应用。根据广泛收集的80个边坡实例，建立了一个由HGA-ANN驱动的评价边坡稳定性的T-S型模糊推理系统模型。对实际边坡预测结果表明，该模型的预测精度明显高于目前同类方法。

关键词　　边坡工程；边坡稳定性；神经网络；遗传算法；T-S模糊推理系统

分类号

FUZZY REASONING SYSTEM DRIVEN BY HGA-ANN FOR ESTIMATION OF SLOPE STABILITY

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Abstract

 Fuzziness exists in thinking and judgment of human brains during the procedures of analysis and design of slope engineering，which will bring fussy indefiniteness to some extent to the whole courses of the analysis and design. Thus slope engineering，in fact，is a dynamic，fuzzy，open and complicated nonlinear system，which makes it difficult to evaluate complicated slopes conforming to reality by the traditional analysis method. Artificial neural networks (ANN) and fuzzy reasoning method，which have been applied to the evaluation of slope stability respectively，have shortcomings of their own so that ANN were used to constitute T-S¢s fuzzy reasoning system and the ANNs were trained by hybrid genetic algorithms (HGA). A new fuzzy reasoning system driven by HGA-based ANN，which was used for estimation of slope stability，was constructed. Based on the 80 slope cases that are collected from the worldwide practical slopes，a new estimation method for slope stability is built up. The proposed HGA-ANN-driven fuzzy reasoning system is actually a weighted combination model. Compared with the maximum likelihood method and BP neural network，the presented model has higher predicting accuracy.

Key words slope engineering；slope stability；artificial neural network；genetic algorithms；T-S fuzzy reasoning system

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