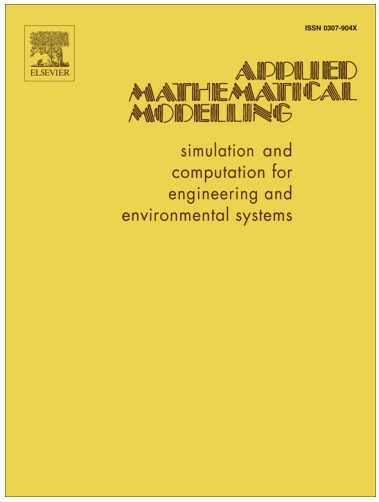

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Fuzzy mathematics model and its numerical method of stability analysis on rock slope of opencast metal mine

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Abstract

Because of the complex nature of rockmass in open-pit mines, it is difficult to accurately measure various factors which have great effect on the slope stability. Based on results of the statistical analysis of a large amount of measured data in geotechnical engineering and civil engineering, the fundamental fuzzy models of rock slope stability are established by using the theory of fuzzy measures. In view of the marked "fuzziness" in the factors that have effect on the problems of slope stability, the deformation failure of rock slope in open-pit mine is studied by using the fuzzy mathematical theory in the paper. In accordance with the deformation failure of rock mass in open-pit mines, by applying the theory of fuzzy probability measures, the fuzzy probability formula is derived for the deformation failure of rock masses, and the numerical method is given to calculate the fuzzy probability. Finally, an engineering example of the rock slope in open-pit mine is calculated and analyzed by using the three-points Gauss-Legendre quadrature formula. The practical calculation shows that the method can be used for analyzing and studying the problems of the slope stability in opencast metal mine.

***Key words*:** Fuzzy mathematics; Fuzzy probability measures; Slope stability; Numerical method; Gauss-Legendre quadrature formula

1. Introduction

As everyone knows, slope stability analyses are used in a wide variety of civil engineering problems and many methods have been used in the stability analysis of rock slope in open-pit mines. The stability of open-pit slopes has always been considered as a very important issue in rock mechanics and mining engineering. In other words, the slope stability in open-pit mine is important because slope failures or landslides can lead to the production safety accidents.

In fact, slope stability is a major problem associated with open-pit mining of metal orebody, causing damage to slope rockmass. To avoid adverse impacts of slope instability, a reliable analysis is essential. In recent years, the prediction and analysis of rock slope stability have been studied by many scholars in this field and valuable results have been obtained [1-19, 21]. Recent efforts include the use of finite-element method [1], genetic algorithm method [2], distinct element method [3], finite difference (FLAC) method [4] and artificial neural network (ANN) method [5, 6] in the prediction of rock slope stability. The probabilistic approach has also been used as a powerful analysis tool for representing uncertainty in the slope instability model and in the rockmass characteristics [7, 8]. However, in practical engineering conditions, the amount of data