A Study on Parameter Uncertainties in Rockfall Simulation Using Discrete Element Method

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ABSTRACT

Discrete Element Method (DEM) has been widely accepted to solve engineering problems in the field of rock mechanics, such as rockfall disasters. The key advantage of this method is to represent shapes of rocks and slopes directly. However, there are still some difficulties in the procedure of input parameter setting, and effects of the parameters have not been sufficiently discussed so far. This study hence aims to quantitatively evaluate the influence of variability of input parameters associated with slopes in rockfall simulations using DEM. A series of rockfall simulations were performed on a virtual slope with a simple configuration, and the effects of three input parameters are investigated: spring coefficient, friction angle, and restitution coefficient. Calculation cases with a spatially uniform slope were firstly performed to check the physical implications of input parameters, and then cases with a spatially non-uniform slope involving random fields were carried out to investigate the effects of standard deviation and autocorrelation length [1]. Each simulation case was performed with enough number of trials, and the effects of input parameters were quantified in the way that a scatter plot of final positions of rockfalls was represented by the Gaussian Mixture Model (GMM) [2][3]. According to the obtained results, we have arrived at the conclusion that the accuracy of the mean value of the parameters is much more important than the consideration of spatial variability of the parameters.

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