عنوان مقاله:

Numerical probabilistic analysis for slope stability in fractured rock masses using DFN-DEM approach

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خلاصه مقاله:

Due to existence of uncertainties in input geometrical properties of fractures, there is not any unique solution for assessing the stability of slopes in jointed rock masses. Therefore, the necessity of applying probabilistic analysis in these cases is inevitable. In this study a probabilistic analysis procedure together with relevant algorithms are developed using Discrete Fracture Network-Distinct Element Method (DFN-DEM) approach. In the right abutment of Karun 4 dam and downstream of the dam body, five joint sets and one major joint have been identified. According to the geometrical properties of fractures in Karun river valley, instability situations are probable in this abutment. In order to evaluate the stability of the rock slope, different combinations of joint set geometrical parameters are selected, and a series of numerical DEM simulations are performed on generated and validated DFN models in DFN-DEM approach to measure minimum required support patterns in dry and saturated conditions. Results indicate that the distribution of required bolt length is well fitted with a lognormal distribution in both circumstances. In dry conditions, the calculated mean value is 1125.3 m, and more than 80 percent of models need only 1614.99 m of bolts which is a bolt pattern with 2 m spacing and 12 m length. However, as for the slopes with saturated condition, the calculated mean value is 1821.8 m, and more than 80 percent of models need only 2653.49 m of bolts which is equivalent to a bolt pattern with 15 m length and 1.5 m spacing. Comparison between obtained results with numerical and empirical method show that investigation of a slope stability with different DFN realizations which conducted in different block patterns is more efficient than the empirical methods.

کلمات کلیدی:

Rock Slope, Discrete fracture network, Probabilistic analysis, Discrete Element Method, Monte Carlo simulation