عنوان مقاله:

APPLICATION OF DEM FOR MODELLING CRACK INITIATION AND PROPAGATION IN ROCK MASSES WITH OPEN AND CLOSED FLAWS

محل انتشار:

پنجمین کنفرانس مکانیک سنگ ایران (سال: 1393)

تعداد صفحات اصل مقاله: 10

نویسندگان:

Z. ALIABADIAN - *Department of Mining and Metallurgical Engineering, Amirkabir University of Technology, Iran*

M. SHARAFISAFA - *Department of Mining and Metallurgical Engineering, Amirkabir University of Technology, Iran*

خلاصه مقاله:

A rock mass is neither a continuous medium nor a totally discrete medium, it is a kind of defect material which contains many cracks, joints and faults. The nonlinear deformation behavior of a rock mass is induced by the propagation and coalescence of cracks and joints under external loads. Therefore, it is of important for rock engineering to analyze the propagation and coalescence process of cracks existed in a rock mass under external loads. The study of crack initiation and propagation is important for the understanding of rock mass behavior which, in turn, affects rock engineering applications, such as tunnels, foundations and slopes, as well as hydrocarbon and geothermal energy extraction. Cracking mechanisms can be studied experimentally in the laboratory or in the field, or numerically. In the present study, distinct element method (DEM) which is capable to model various discontinuities was employed to simulate crack initiation and propagation in a rock masse specimen containing a single open and closed flaw. Initially, a rock domain containing a closed flaw was considered to model crack propagation. The analysis was performed by sequential modelling. Firstly, a model containing a single closed or open flaw was used to verify the types of propagation shown by Park and Bobet (2009). In these analyses, both open and closed flaws were considered and analyzed with different spatialdistribution (i.e. flaw angle). After results verification, the effect of open flaw filling material on crack propagation was analyzed numerically. This characteristic has not yet been studied in crack propagation studies. The results obtained from open and closed flaws were in good agreement with experimental ones. All cracks mentioned in experimental literatures such as wing (tensile) cracks, coplanar secondary (shear) cracks and oblique secondary cracks were modelled successfully using DEM which indicates method capability to model nonlinear behavior of rock masses subjected to external loadings. The emphasize of the study is to investigate the effects of open flaws containing filling material on crack initiation and propagation. Weak material was modelled as filling material. The results showed that when flaw is filled with weak materials (as it encountered frequently in natural rock masses) the cracking pattern is quite different with open flaws. In these occasions, the crack propagation direction is different. This phenomenon could be described in terms of stress attenuation in weak filling ... material, as stress concentration in filling materials causes change in crack

کلمات کلیدی:

Rock Discontinuity; Crack Propagation and Coalescence; DEM; Open and Closed Flaws; Filling Material

لینک ثابت مقاله در پایگاه سیویلیکا: