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Prediction of Fracture Aperture in Fragmented Rocks

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Abstract : In fractured rock masses open fractures tend to act as the main pathways of fluid flow. The permeability of a rock fracture depends on its aperture. The change of aperture with stress can cause a many-orders-of-magnitude change in the hydraulic conductivity at moderate compressive stress levels. In this study, the change of aperture in fragmented rocks is investigated using finite element analysis. A full 3D mechanical model of a simplified version of an outcrop analog is created and studied. A constant initial aperture value is applied to all fractures. Different far field stresses are applied and the change of aperture is monitored considering the block to block interaction. The fragmented rock layer is assumed to be sandwiched between softer layers. Frictional contact forces are defined at the layer boundaries as well as among contacting rock blocks. For a given in situ stress, the blocks slide and contact each other, resulting in new aperture distributions. A map of changed aperture is produced after applying the in situ stress and compared to the initial apertures. Subsequently, the permeability of the system before and after the stress application is compared.

Keywords : fractured rocks, mechanical model, aperture change due to stress, frictional interface
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