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Numerical Simulation of Fracturing Behaviour of Pre-Cracked Crystalline Rock Using a Cohesive Grain-Based Distinct Element Model

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Abstract : Understanding the cracking response of crystalline rocks at mineralogical scale is of great importance during the design procedure of mining structures. A grain-based distinct element model (GBM) is employed to numerically study the cracking response of Barre granite at micro- and macro-scales. The GBM framework is augmented with a proposed distinct element-based cohesive model to reproduce the micro-cracking response of the inter- and intra-grain contacts. The cohesive GBM framework is implemented in PFC2D distinct element codes. The microstructural properties of Barre granite are imported in PFC2D to generate synthetic specimens. The microproperties of the model is calibrated against the laboratory uniaxial compressive and Brazilian split tensile tests. The calibrated model is then used to simulate the fracturing behaviour of pre-cracked Barre granite with different flaw configurations. The numerical results of the proposed model demonstrate a good agreement with the experimental counterparts. The GBM framework proposed thus appears promising for further investigation of the influence of grain microstructure and mineralogical properties on the cracking behaviour of crystalline rocks.

Keywords : discrete element modelling, cohesive grain-based model, crystalline rock, fracturing behavior
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