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The Failure and Energy Mechanism of Rock-Like Material with Single Flaw

Authors : Yu Chen

Abstract : This paper investigates the influence of flaw on failure process of rock-like material under uniaxial compression. In laboratory, the uniaxial compression tests of intact specimens and a series of specimens within single flaw were conducted. The inclination angle of flaws includes 0°, 15°, 30°, 45°, 60°, 75° and 90°. Based on the laboratory tests, the corresponding models of numerical simulation were built and loaded in PFC2D. After analysing the crack initiation and failure modes, deformation field, and energy mechanism for both laboratory tests and numerical simulation, it can be concluded that the influence of flaws on the failure process is determined by its inclination. The characteristic stresses increase as flaw angle rising basically. The tensile cracks develop from gentle flaws ($\alpha \leq 30°$) and the shear cracks develop from other flaws. The propagation of cracks changes during failure process and the failure mode of a specimen corresponds to the orientation of the flaw. A flaw has significant influence on the transverse deformation field at the middle of the specimen, except the 75° and 90° flaw sample. The input energy, strain energy and dissipation energy of specimens show approximate increase trends with flaw angle rising and it presents large difference on the energy distribution.

Keywords : failure pattern, particle deformation field, energy mechanism, PFC
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