

Crack propagation trajectories for rocks under mixed mode I-II fracture

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Abstract: Propagation of a crack in engineering materials including rocks can cause failure. Knowledge of the stress state under which a crack can propagate, and the trajectory it may follow during its growth are thus very important for the stability of rock masses/materials and for the safe design of structures in/on rocks. In this paper, the crack initiation angle and subsequent crack propagation path are experimentally investigated for limestone rock specimens. This investigation was conducted under various mixed mode I-II loading conditions, including pure mode-I and pure mode-II. This study includes conducting diametrical compression tests on notched Brazilian disk specimens. Moreover, the effect of confining pressure and temperature on crack initiation and propagation were also studied. The experimental results were compared with theoretical predictions of crack initiation angle. The results showed that limestone behaves in brittle fashion, and the effects of confining pressure and temperature on failure trajectories were not significant. Generally, the crack initiation angle can be predicted by the maximum tangential stress criterion. However, for notched Brazilian disk with high value of crack orientation with respect to loading direction, crack does not propagate from the tip of the crack. This important observation indicated that the tensile-strength failure can become more critical than the fracture-toughness failure. © 2005 Elsevier B.V. All rights reserved