Accepted Manuscript

Frictional Crack Initiation and Propagation in Rocks under Compressive Loading

Mahmoud Alneasan, Mahmoud Behnia, Raheb Bagherpour

PII:	\$0167-8442(18)30233-7
DOI:	https://doi.org/10.1016/j.tafmec.2018.08.011
Reference:	TAFMEC 2090
To appear in:	Theoretical and Applied Fracture Mechanics
Received Date:	15 May 2018
Revised Date:	22 July 2018
Accepted Date:	13 August 2018
Reference: To appear in: Received Date: Revised Date: Accepted Date:	 TAFMEC 2090 <i>Theoretical and Applied Fracture Mechanics</i> 15 May 2018 22 July 2018 13 August 2018



Please cite this article as: M. Alneasan, M. Behnia, R. Bagherpour, Frictional Crack Initiation and Propagation in Rocks under Compressive Loading, *Theoretical and Applied Fracture Mechanics* (2018), doi: https://doi.org/10.1016/j.tafmec.2018.08.011

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Frictional Crack Initiation and Propagation in Rocks under Compressive Loading

Mahmoud Alneasan^{1,2}, Mahmoud Behnia¹*, Raheb Bagherpour¹

Abstract

Crack initiation and propagation in a brittle material such as a rock are affected by the friction between crack surfaces. Choosing an appropriate fracture criterion for frictional crack surfaces plays an important role in determining fracture parameters. To this end, a two-dimensional crack propagation code (TDCPC) was developed in this study based on the displacement discontinuity method (DDM) to predict the crack propagation path under the effect of friction. In this study, three classes of fracture criteria were defined: 1) classical fracture criteria (maximum tangential stress criterion, minimum strain energy density criterion, and maximum strain energy release rate criterion) under mixed mode loading without the effect of friction (CFC-I-II), 2) classical fracture criteria under the pure mode II (shear fracturing) without the effect of friction (CFC-II), and 3) the Swedlow criterion which takes into account the effect of friction between crack surfaces (SW-II). A special element (Swedlow-element) was developed and used in the displacement discontinuity method to predict crack trajectories under the effect of friction. The Swedlow criterion was developed to study the fracture process under bi-axial loading. Results indicated that CFC-I-II are not valid for frictional crack surfaces. Crack propagation paths predicted by CFC-II and SW-II under uniaxial loading proved that friction coefficient has a significant effect on the crack initiation angle (the first stages of the crack propagation path), and away from the crack tip, CFC-II and SW-II almost have the same path. For bi-axial loading, crack propagation paths predicted by SW-II deviate away from the original crack as friction coefficient is increased. The stress ratio (K_0) and friction coefficient have opposite effects on the crack propagation path. Crack trajectory deviates away from the original crack under the effect of friction coefficient and moves toward the original crack under the effect of the stress ratio. The present study indicated that the results predicted using TDCPC are in good agreement with the experimental and numerical results of other studies.

Keywords: Closed crack situation, classical fracture criteria, Swedlow criterion, crack propagation path, friction coefficient, stress ratio.

¹ - Department of Mining Engineering, Isfahan University of Technology (IUT), Isfahan 8415683111, Iran

² - Scholarship of Tishreen university, Latakia, Syria

^{*-}Behnia@cc.iut.ac.ir

Download English Version:

https://daneshyari.com/en/article/11004090

Download Persian Version:

https://daneshyari.com/article/11004090

Daneshyari.com