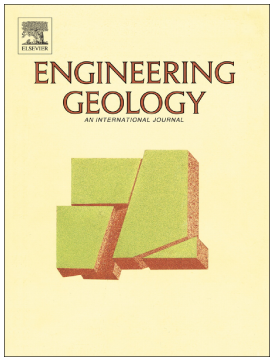

Experimental study of flow characteristics in non-mated rock fractures considering 3D definition of fracture surfaces

Guan Rong, Di Hou, Jie Yang, Long Cheng, Chuangbing Zhou

PII: S0013-7952(17)30188-6
DOI: doi: 10.1016/j.enggeo.2017.02.005
Reference: ENGEO 4485

To appear in: *Engineering Geology*

Received date: 20 June 2016
Revised date: 20 December 2016
Accepted date: 4 February 2017

Please cite this article as: Guan Rong, Di Hou, Jie Yang, Long Cheng, Chuangbing Zhou , Experimental study of flow characteristics in non-mated rock fractures considering 3D definition of fracture surfaces. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Engeo(2017), doi: 10.1016/j.enggeo.2017.02.005

Experimental Study of Flow Characteristics in Non-mated Rock Fractures Considering 3D Definition of Fracture Surfaces

Guan Rong[1, 2,*], Di Hou[1,3], Jie Yang[1,2], Long Cheng[1, 2], Chuangbing Zhou[1,2]

1. *State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan，Hubei 430072, China*
2. *Key Laboratory of Rock Mechanics in Hydraulic Structural Engineering, Ministry of Education, Wuhan University, Wuhan, Hubei 430072, China*
3. *Guizhou survey & design research institute for water resources and hydropower, Guiyang, Guizhou 550002, China*

[*] Corresponding author, *Email address:* rg_mail@163.com

Abstract: Three-dimensional (3D) morphology of rock fracture has a great influence on its hydraulic behavior. To experimentally investigate the 3D roughness dependent non-linear flow characteristics in deformable rock fractures, water flow tests through non-mated fractures were conducted under normal stresses ranging from 1.0 MPa to 5.0 MPa. Three types of granite samples were selected to produce rock fracture with different roughness. A 3D morphology parameter was used in the experiments to better understand the influence of joint roughness on the flow characteristics. By incorporating the 3D roughness metric, we proposed a new formula to describe the non-linear flow in rock fracture. The non-linear flow characteristics including the critical Reynolds number, Forchheimer's linear coefficient and nonlinear coefficient are analyzed and discussed. In addition, comparison among the proposed equation, Lomize's equation, Forchheimer equation and Izbash's law are examined from the perspective of the rationality of the formula. The limitations of Lomize's equation, Forchheimer equation and Izbash's law are analyzed in detail. The results show that the proposed equation is easier in the structure and more meaningful from an engineering point of view.

Key words: Rock fracture; Non-linear flow model; Three-dimensional (3D) morphology; Apparent transmissivity