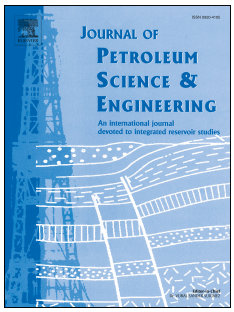
Accepted Manuscript



A study of 3D modeling of hydraulic fracturing and stress perturbations during fluid injection

V. Roche, M. van Der Baan, G. Preisig

PII: S0920-4105(18)30526-6

DOI: 10.1016/j.petrol.2018.06.037

Reference: PETROL 5044

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 30 November 2017

Revised Date: 21 May 2018

Accepted Date: 16 June 2018

Please cite this article as: Roche, V., van Der Baan, M., Preisig, G., A study of 3D modeling of hydraulic fracturing and stress perturbations during fluid injection, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.06.037.

A study of 3D modeling of hydraulic fracturing and stress perturbations during fluid injection

V. Roche [1, 3*], M. van Der Baan, G. Preisig [2],

1: Dept. of Physics, CCIS, University of Alberta, Edmonton AB, T6G 2E1, Canada
2: Geological Engineering, EOAS, University of British Columbia, Vancouver BC, Canada.

***** Corresponding Author: roche@ualberta.ca

Acknowledgements

The authors thank the sponsors of the Microseismic Industry Consortium for financial support, and Itasca International and Itasca Image for software licenses to 3DEC.

Abstract

This paper investigates a hydraulic fracture development and its potential impact in terms of elastic stress perturbations and fracture triggering. The hydraulic fracture is simulated during fluid injection with a fully coupled hydromechanical 3D discrete-element method in a homogeneous granite without (i.e. intact rock) and with preexisting fractures network. The results of the models show how preexisting fractures affect the growth rate, the accumulation of the displacement and interaction between hydraulic and mechanically-induced fractures. In the intact rock model, a circular hydraulic fracture grows normal to the minimum principal stress due to successive tensile failures. The measured length of the hydraulic fracture increases as a fractional power of time for a constant injection rate and the maximum aperture is positively correlated to the length. Stress perturbations observed in the model promote tensile and shear failure at the hydraulic fracture tips, but inhibit failure near the fracture walls. We expect microseismicity to be concentrated near the