The Canadian Geotechnical Society — La Société Canadienne de Géotechnique

Manitoba Section

CGS Luncheon Presentation

Hydraulic fracturing: rock characterisation and elastic-plastic fracture propagation

Presented by:

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Ph.D. Candidate (Geotechnical Engineering), University of Manitoba

Presentation Abstract:

Hydraulic fracturing (or fracking) is the hydraulic stimulation by injecting pressured water into a borehole to create fractures and increase the permeability of the formation. The formation with enhanced permeability is used for hydrocarbon exploitations or Enhanced Geothermal Systems (EGS). During the hydraulic stimulation, tensile stress within the rock matrix may exceed its tensile strength and cause a tensile fracture. The resulting tensile fractures (i.e. hydro-fractures) may join to each other and to existing natural fractures and create a network of interconnected fractures. The initiation and propagation of hydro-fractures have been investigated experimentally and numerically in early and recent studies. However, the mechanical behaviour of the solid matrix is mostly considered to be elastic. This is contradicting the physical behaviour of shale gas formation, where their clay mineral content causes nonlinear deformation during hydraulic stimulation. In this presentation, first, an experimental approach is presented to characterize the consolidated porous media properties. Lastly, the numerical method is introduced to simulate the plastic growth of the fractures when the solid rock is under plastic deformation. The results of porous media properties and fracture's initiation and propagation will be presented and compared to the corresponding available experimental data.

About the Presenter:

Miad completed his M.Sc. in Mechanical Engineering, Fluid Dynamics, at the Iran University of Science and Technology and continued his studies as a Ph.D. Candidate at the Department of Civil Engineering (Geotechnical), University of Manitoba, since January 2016. Miad's research is focused on hydraulic fracturing and rock characterization using numerical and experimental approaches. Recently, he has simulated plastic fracture propagation coupled with solid deformation during research at the German Research Centre for Geosciences (GFZ), Potsdam, Germany, funded by a Mitacs Globalink Research Award in February 2018. He will present the results of this study in his presentation.

Date: Wednesday, December 18, 2019
Time: Lunch at 12:00 PM, Presentation at 12:20 PM
Location: Holiday Inn South, 1330 Pembina Highway
RSVP: 12:00 PM, Monday, December 16, 2019

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This presentation is in collaboration with the International Association of Hydrogeologists Canadian National Chapter.

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