

Characterizing fracture complexity and fracture type in laminated Montney Formation through laboratory true-triaxial hydraulic fracturing tests

Prof. Giovanni Grasselli and Dr. Aly Abdelaziz
NSERC-Energi Simulation IRC

Thursday, September 7, 2023, 9 a.m. Central Time

Prof. Giovanni Grasselli and Dr. Aly Abdelaziz will jointly speak on Thursday, September 7, 2023, at 9:00 a.m. Central Time. Prof. Grasselli is a Professor and the NSERC/Energi Simulation Industrial Research Chair in Fundamental Petroleum Rock Physics and Rock Mechanics at the University of Toronto. Dr. Abdelaziz is the NSERC/Energi Simulation IRC Project Manager. The topic is “*Characterizing fracture complexity and fracture type in laminated Montney Formation through laboratory true-triaxial hydraulic fracturing tests.*”

Abstract

A series of laboratory true-triaxial hydraulic fracturing tests were carried out on shale specimens from Montney formation outcrop and from core at depth. The tests were designed such that they replicate in-situ like open-hole fluid injection at depth. The testing scheme aimed at assessing the impacts of flaws/anisotropy, intermediate stress, and fluid viscosity.

The formation of a fractures opening against σ_2 instead of σ_3 in the true-triaxial hydraulic fracturing experiments defies the dogmatic expectation that the fractures will always propagate against the minimum principal stress direction. The results are a clear indication that the tensile strength anisotropy plays an equally important factor to the in-situ stresses with respect to fracture initiation and propagation. The outcome of this experimental work is a new conceptual model that is not tied only to the magnitude of the in-situ stress but rather identifies the plane with minimal mechanical resistance defined by the magnitude of the principal stress and the anisotropy in the tensile strength of the rock formation. Another important result of this experimental program confirms the influence of viscosity on the complexity of the associated fracture network.

Biographies



Giovanni Grasselli
NSERC-Energi
Simulation IRC for the
Department of Civil &
Mineral Engineering
giovanni.grasselli@utoronto.ca

Giovanni Grasselli is a Professor and the NSERC/Energi Simulation Industrial Research Chair in Fundamental Petroleum Rock Physics and Rock Mechanics at the University of Toronto.

Dr. Grasselli holds an undergraduate degree in Civil Engineering (1995) from the University of Parma, Italy, and a PhD in Rock Mechanics (2001) from the Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland. Before joining the University of Toronto as a faculty in 2006, he has been research fellow at the Imperial College London (UK), Sandia National Laboratories (USA) and has served as associate director at Laurentian University's Mirarco (Canada). He received the prestigious 2004 ISRM Rocha Medal, the 2019 CGS' John A. Franklin Award in Rock Mechanics, and supervised two Rocha Medal winners (2015 and 2017). His research focuses on hybrid finite-discrete element (FDEM) numerical technology, experimental visualization techniques, and geomechanics principles applied to the study of tunneling and hydraulic fracturing.



Aly Abdelaziz:
NSERC/Energi Simulation
IRC Project Manager
aly.abdelaziz@mail.utoronto.ca

Aly Abdelaziz is a 2023 PhD Graduate from Professor Grasselli's Geomechanics Group in the Civil & Mineral Engineering Department at the University of Toronto in Canada with a Bachelors in 2007 in Civil - Structural Engineering at Benha University in Egypt. Aly has gained professional experience working for more than eight years as a geotechnical investigation and construction monitoring and material testing laboratory in Dubai. His research broads several interests which include model generation using spatial Voronoi tessellations and measuring influence of machines on strains during testing. He also worked on true-triaxial hydraulic fracturing test to develop an understanding of rock stimulation in the context of fracture complexity and fracture type. In addition, he constantly strives to bridge gaps between his professional knowledge and the academic world to achieve balance between academic practice and industry standards.