2D and 3D Modeling of Rock Fracturing Processes in Geomechanics

This hands-on short course covers:

- Numerical modeling of complex, non-linear, coupled rock engineering problems

- Simulation of rock fracture and fragmentation in 2D and 3D

- Fluid flow and fluid-induced rock fracturing

- Fundamental principles of the state-of-the-art **Irazu** finite-discrete element software

- Hands-on **Irazu** tutorials

Get a free full-featured demo version of Geomechanica's flagship Irazu software!

Case study: 3D simulation of excavation-induced fracturing

Workshop Description

The finite-discrete element method (FDEM) is a numerical approach that combines continuum mechanics principles with discrete element algorithms to simulate multiple interacting deformable and fracturing bodies. With its ability to qualitatively and quantitatively reproduce failure processes in brittle materials, FDEM is gaining increasing acceptance in civil, mining, and petroleum engineering applications, where fracture and fragmentation processes are key to fully understanding the rock mass behaviour. Geomechanica's *Irazu* software is a GPU-accelerated, hydro-mechanically coupled, FDEM-based modelling package capable of simulating the interaction between new fractures and pre-existing rock mass discontinuities in 2 and 3 dimensions.

This one-day course will combine theoretical lectures on the fundamental principles of FDEM with practical modeling sessions where participants will be guided through several simulation cases. The course will start with a general introduction to the FDEM modelling philosophy and its application to engineering geology, rock mechanics, and geophysics problems. After a quick review of the basic algorithms, such as finite element deformation, contact detection, and contact interaction, the fracture model will be discussed in more depth. More advanced features of Irazu, including: in-situ stress initialization, rock excavation, and Discrete Fracture Networks (DFNs), and hydro-mechanical coupling will also be introduced. In the second part of the course, participants will gain valuable hands-on experience through a series of practical modelling exercises using Geomechanica's Irazu software to model practical rock fracturing problems.
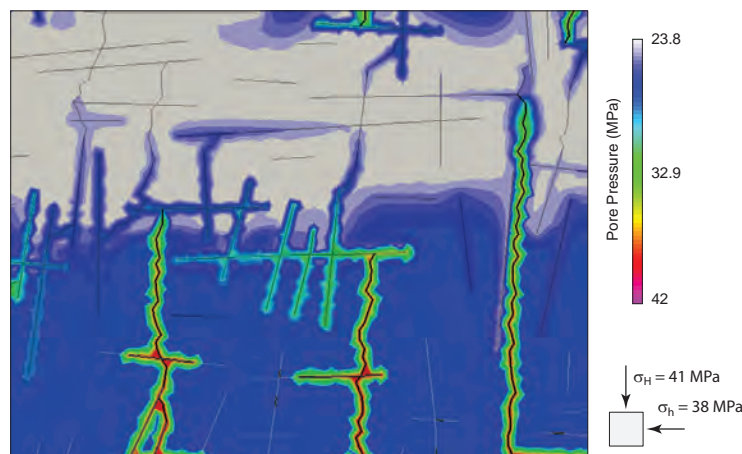
Case study: simulation of hydraulic fracturing and well interaction

Workshop Objectives

By attending this short course, participants will learn the basic concepts and algorithms embedded into FDEM and how to work with it. Attendees will leave the course with a basic understanding

of the FDEM simulation approach, its strengths, limitations, and how it can be applied to model complex engineering problems, such as underground excavations in discontinuous rock masses and hydraulic fracturing in unconventional plays. Participants will learn how to build FDEM models in Geomechanica's Irazu software, including the assignment of correct input parameters, and post-processing of the results.

Target Audience

This one-day course is specifically designed for geotechnical, geological, mining and petroleum engineers, as well as undergraduate and post-graduate students and researchers. In particular, anyone who wishes to use or is considering using FDEM to tackle challenging rock mechanics problems would benefit from this course.

Provided Materials

The short course organizer will provide each participant with: (i) electronic copies of the course slides, (ii) electronic copies of the Irazu software manual and tutorials, and (iii) a **free, full-featured demo version of the Irazu software**.

Company Profile and Instructors

Geomechanica Inc. is an engineering company that develops simulation software and provides simulation-aided, technical consulting and laboratory testing services for rock engineering applications in the civil, mining, petroleum, and nuclear waste disposal industries. Our mission is to solve challenging rock mechanics problems via the adoption of state-of-the-art, physically-sound computer simulation methods (Irazu). Geomechanica strives to provide innovative solutions to complex design and analysis problems with its interdisciplinary team of engineers, scientists, and mathematicians.

Andrea Lisjak is the numerical modelling lead and a co-founder of Geomechanica. His area of expertise lies in the development and use of finite-discrete element numerical methods to investigate failure processes in rocks. He is the recipient of the 2015 Rocha Medal of the ISRM. He holds a PhD degree in Civil Engineering (rock mechanics) from the University of Toronto, Canada.

Bryan Tatone is the laboratory testing lead and a co-founder of Geomechanica. In addition to laboratory testing, his technical interests include numerical simulation of a variety of rock mechanics and rock engineering problems. He is the recipient of the 2017 Rocha Medal of the ISRM. He holds a PhD degree in Civil Engineering (rock mechanics) from the University of Toronto, Canada.

GEOMECHANICA

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Event information:

Venue	52nd US Rock Mechanics/
	Geomechanics Symposium
Where	Westin Seattle, Seattle
	Washington, USA
When	Sunday, June 17, 2018
Website	www.armasymposium.org