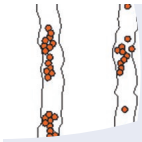
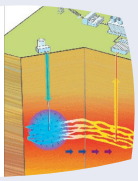
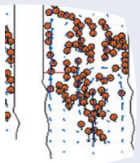




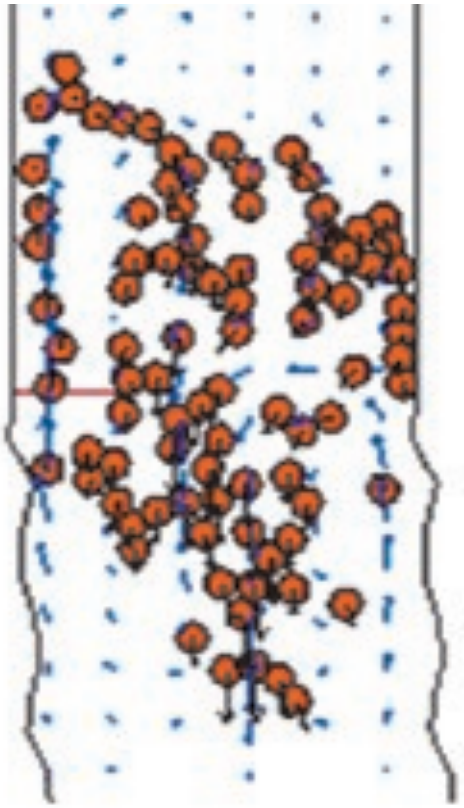


Presented By:
Ingrid Tomac, Ph.D.
Post-Doc Fellow
Colorado School of Mines

Environmental Engineering *Seminar Series*

Friday, June 6th, 2014
McDonnell Douglas Auditorium (MDEA)
1:30PM-2:20PM

Micromechanical Study of Proppant Flow and Transport in Fracture



Enhanced geothermal systems (EGS) are aimed to be used for electrical energy production in locations without sufficient fluid and steam from the deep underground rock formation. EGS utilize hydraulic fracturing technique for increasing the permeability of hot dry igneous rock mass. This presentation shows results of a study on micromechanical understanding of proppant flow and transport in rough granite hydraulic fracture. Proppant is composed of sand grains which can be transported into newly formed fractures together with fracturing fluid in order to prop the fractures open for a long term use. Placing proppant in a rough and narrow hydraulic fracture exhibits a so-called dense phase solid-fluid coupled flow, whose behavior is generally difficult to model because inter-particle collisions are frequent and dominate the slurry flow. Discrete Element Method coupled with Computational Fluid Dynamics is particularly suitable for studying dense phase coupled flow because particles are modeled as discrete entities whose motion can be individually tracked while they interact with surrounding fluid in a two-way manner. A new particle contact model that accounts for viscous fluid lubrication is built upon existing Discrete Element Method coupled with Computational Fluid Dynamics code. Fluid lubrication formulation defines how a thin layer of viscous fluid between two approaching particles dissipates their kinetic energy in a non-linear way. As a result, inter-particle forces dynamically change and affect both solids transport and fluid flow field in fracture. The influence of fluid viscosity, particle initial concentration in a slurry, pressure drop in fracture and the ratio between particle diameter and fracture width on proppant flow and transport is investigated. The results of parametric study reveal how critical combination of parameters enhances fluid lubrication effect and promotes particle aggregation in fracture and its clogging.

Speaker Bio

Dr. Ingrid Tomac graduated with a Ph.D. from Colorado School of Mines in January 2014. She holds a Masters of Engineering in Structural and Masters of Science in Geotechnical engineering degrees from Civil Engineering Department, University of Zagreb, Croatia. Her recent research focuses on understanding the mechanisms of hydraulic fracturing and proppant flow and transport for geothermal reservoirs.