Mahshad Samnejad

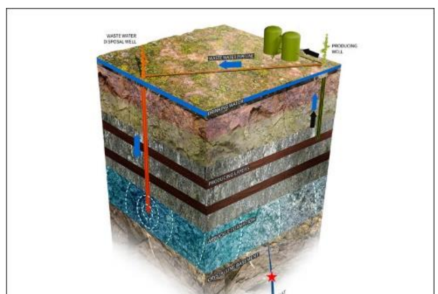
I am a Ph.D. student of Petroleum Engineering at the University of Southern California, working on permeability enhancement modeling during hydraulic fracturing stimulation activities. My unique background in both Petroleum Engineering and Geoscience Technologies, has enabled me to tackle various complex multi-physics problems, such as permeability evolution during hydraulic fracturing initiation and propagation, reservoir poroelastic and poroplastic behavior, rock failure, as well as seismic observations of such processes. My participation in multiple cross-disciplinary group projects has exposed me to a diversity of team collaboration experiences. I can be reached at samnejad@usc.edu.

Areas of technical Interest: Hydraulic Fracturing, Geomechanics, Reservoir Seismic Response

Dissertation Topic: Fractured rock permeability variations evaluation from seismic velocity changes using a coupled simulation scheme

In today's world, various increasingly important subsurface exploitation applications, such as oil and gas hydraulic fracturing operations as well as enhanced geothermal systems, depend on fracture initiation and stimulation operations. On the contrary, in waste injection sites, fractures are to be inhibited in order to avoid leakage and potential contamination of groundwater, as well as fault lubrication. In all these activities, fluid flow processes both affect and are affected by rock and fracture mechanics. This creates a vast area of opportunities for research pertaining to fluid flow through fractured rock. In particular, my dissertation will meet the need of incorporating our understanding of multi-physical processes of fractures initiation and propagation into computational modeling and simulation of reservoir response, in terms of flow, mechanics, and fracturing behavior.

There are a variety of methods available in the literature for addressing the problem of modeling and simulation of hydraulic stimulation. Simple Planar Fractures extending away from the wellbore have been widely used in the industry giving limited results. More realistic and complex fracture networks are handled in Discrete Fracture Network models; however, such methods require prior knowledge of failure locations. This means one needs to specify the crack path in advance in order to be able to obtain propagation results. In addition, such methods, as well as cohesive zone element methods introduce mesh dependency problems since they treat fractures as planes of discontinuity, which are required to be defined in the model mathematically before running simulations. Several efforts have been done in order to overcome the problem of mesh dependency, only being able to model large scale discontinuities, which would be insufficient for modeling complexities in the case of reservoir rocks, having various scales of heterogeneity and micro-inclusions. In my work, we use Continuum Mechanics for this purpose, in which the stimulated rock is modeled as a continuum, the properties of which are represented using an overall fictitious intact substituent. We simulate how reservoir pressure, permeability, stresses, and configuration change as a result of production, injection, and fracturing activities in an evolving sense.



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