**Hydromechanical Scaling of Field and Laboratory Single Fractures**

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**ABSTRACT:**

Seismic characterization methods provide insight into the mechanical properties of rock fractures but not the hydraulic properties of fractures. By studying the scaling relationship between the mechanical and hydraulic properties of fractures, we provide an avenue to characterize, remotely, the hydraulic properties of fractures.

In this study, fractures were numerically generated at five sizes (1, 0.5, 0.25, 0.125, and 0.0625m on an edge) to provide an order of magnitude variation. Each fracture was constructed such that the contact area covered approximately 5-9% of the fracture. The rocks were also given the properties of granite and stressed to a maximum load of 80 MPa. When solving for the deformation of the fracture plane both free and periodic boundary conditions were considered. Free surfaces conditions represent deformations one would measure a laboratory environment (constant displacement) whereas periodic conditions represent field measurements. The deformation was solved in 50 incremental steps in stress so that the flow rate could be monitored during the loading.

The closure of field type fractures (periodic boundary conditions) resulted in a very clear percolation threshold. This differed from laboratory type fractures (free surface boundary conditions) where the threshold could not be determined. This scaling breakdown occurs when the contact area growth, via stress, is non-uniform. With this in mind, a clear hydraulic scaling can be seen for field fractures. Finally, when linking fluid flow and fracture stiffness, we see field type fractures display a scale invariant behavior.

Acknowledgments: This work is supported by the Geosciences Research Program, Office of Basic Energy Sciences US Department of Energy (DEFG02-97ER14785 08), by the Geo-mathematical Imaging Group at Purdue University, and the Purdue Research Foundation.