Geophysical Research Abstracts
Vol. 20, EGU2018-5059, 2018
EGU General Assembly 2018

Surface roughness analysis in numerical models of rock fracture

Steffen Abe (1) and Oskar Kottwitz (2)

(1) Institute for Geothermal Ressource Management, Mainz, Germany (s.abe@igem-energie.de), (2) Institute for Geosciences, University of Mainz, Germany

The roughness of fracture surfaces in rocks plays a role in the control of a wide range of geological processes, ranging from the mechanical behavior of faults to the flow of fluids in rock joints and fault zones. Of particular interest are the statistical properties of fracture surfaces which can be used to estimate the aperture distribution between two non-matching surfaces and its stress dependence, thus giving an insight into the fluid flow permeability in such a fracture. However, the processes and parameters which control the roughness of fracture surfaces in rocks are not fully understood yet. Numerical simulations are a useful way to study the process of rock fracture and the parameters controlling the shape of the fracture surfaces.

Here we present a numerical approach and initial results studying the influence of deformation conditions and rock strength parameters in a simulated deformation experiment on the roughness of the generated fracture surfaces. The Discrete Element Method (DEM) is used to simulate the fracture of a rock sample under a range of loading conditions. The stress path of the deformation is controlled by the application of appropriate confining forces to the side surfaces of the rock sample while it is shortened along its long axis. Rock strength and elastic properties are modelled by using suitable parameters for the bonds between the particles in the DEM. This approach allows to model the strength distribution in granular rocks by using different bond properties within and between the grains.

The fracture surfaces generated in the deformation simulations are extracted from the models based on the connectivity of the generated rock fragments. The extracted fracture surfaces are then transformed into height maps and standard roughness analysis tools such as RMS correlation analysis and spectral analysis are applied.