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# Permeability of displaced fractures

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Flow along fractures or in fissured systems becomes increasingly important in the context of Enhanced Geothermal Systems (EGS), shale gas recovery or nuclear waste deposit. Commonly, the permeability of fractures is approximated using the Hagen-Poiseuille solution of Navier Stokes equation. Furthermore, the flow in fractures is assumed to be laminar flow between two parallel plates and the cubic law for calculating the velocity field is applied.

It is a well-known fact, that fracture flow is strongly influenced by the fracture surface roughness and the shear displacement along the fracture plane. Therefore, a numerical approach was developed which calculates the flow pattern within a fracture-matrix system. The flow in the fracture is described by a free fluid flow and the flow in the matrix is assumed to be laminar and therefore validates Darcy's law. The presented approach can be applied for artificially generated fractures or real fractures measured by surface scanning. Artificial fracture surfaces are generated using the power spectral density of the surface height random process with a spectral exponent to define roughness. For calculating the permeability of such fracture-matrix systems the mean fracture aperture, the shear displacement and the surface roughness are considered by use of a 3D numerical simulator.

By use of this approach correlation between shear displacement and mean aperture, shear displacement and permeability, as well as surface roughness and permeability can be obtained. Furthermore, the intrinsic measured permeability presents a combination of matrix and fracture permeability. The presented approach allows the separation and quantification of the absolute magnitudes of the matrix and the fracture permeability and the permeability of displaced fractures can be calculated. The numerical approach which is a 3D numerical simulation of the fracture-matrix system can be applied for artificial as well as real systems.