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Investigation of Polyaxial Stress-Dependent Permeability of Three-Dimensional Fractured Rocks using TOUGH-DPUM

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Abstract Text:

Discontinuities, such as joints, faults and bedding planes, widely exist in crustal rocks, and often dominate hydro-mechanical processes in the subsurface. The understanding of the nontrivial effect of natural fractures on hydrological properties of rock masses is important for many engineering applications (e.g. petroleum recovery, groundwater management and geothermal production). In this work, we study the influence of polyaxial (ture-triaxial) stresses on the permeability of a three-dimensional (3D) fractured rock using a fully-coupled TOUGH-DPUM numerical model. The geomechanical behavior of the 3D fractured rock in response to in-situ stresses is modeled by a certain of discontinuous partition of unity methods (DPUM), which can capture the deformation of matrix blocks, variation of stress field, shear and opening of pre-existing fractures, and propagation of new cracks; the fluid flow through the fractured porous media is modeled by TOUGH2, which can capture the flow dynamics in both fractures and porous matrix. Simulation of fully-coupled hydro-mechanical processes is achieved by conservatively linking the solid and fluid fields during the iterative computation. A series of numerical simulations is designed to load the fractured rock using various polyaxial in-situ stresses and the stress-dependent flow permeability is further calculated.

Session Selection:
Coupled thermo-hydro-mechanical-chemical-biological processes in subsurface systems

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