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Coupled poro-elasto-plasticity of geomaterials: Simulation and validation

Wednesday, 1 June 2022 11:15 (15 minutes)

Coupled flow and deformation processes have a significant influence on subsurface activities such as carbon sequestration, geothermal recovery, and nuclear waste disposal. Success of these activities requires accurate numerical modeling of flow and deformation in geomaterials. In this work, the Sandia Sierra Multiphysics toolkit with the fixed stress scheme is used to evaluate poro-elasto-plasticity through the thermal/fluid mechanics module ARIA and solid mechanics module. Here, a Kayenta generalized plasticity model is employed where the Kayenta model uses a shear yield function to generate a differentiable yield surface including a "cap" at higher mean stresses. The accuracy of the solution under stresses that induce elasticity, elasto-plasticity, and full plasticity are numerically evaluated against two analytical solutions and validated against experimental data. For the numerical verification with analytical solutions, indentation over the flat surface with a sphere indenter and plane stress field with an injection through a central hole are considered. For experimental validation, the wellbore breakout testing with Mancos shale will be evaluated with detailed mapping of mineral phases and material properties. This problem is used to assess the effects of geomaterial parameters in the Kayenta model and convergence criteria on the fixed stress scheme. SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

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Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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