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TI: Orientation Effects in Fault Reactivation in Geological CO2 Sequestration
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AB: Geological CO2 sequestration remains one of the most promising option for reducing the greenhouse gases emission. The accurate simulation of the complex coupled physical processes occurring during the injection and the post-injection stage represents a key issue for investigating the feasibility and the safety of the sequestration. The fluid-dynamical and geochemical aspects related to sequestering CO2 underground have been widely debated in the scientific literature over more than one decade. Recently, the importance of geomechanical processes has been widely recognized. In the present modeling study, we focus on fault reactivation induced by injection, an essential aspect for the evaluation of CO2 sequestration projects that needs to be adequately investigated to avoid the generation of preferential leaking path for CO2 and the related risk of induced seismicity. We use a geomechanical model based on the structural equations of poroelasticity solved by the Finite Element (FE) - Interface Element (IE) approach. Standard FEs are used to represent a continuum, while IEs prove especially suited to assess the relative displacements of adjacent elements such as the opening and slippage of existing faults or the generation of new fractures [1]. The IEs allow for the modeling of fault mechanics using an elasto-plastic constitutive law based on the Mohr-Coulomb failure criterion. We analyze the reactivation of a single fault in a synthetic reservoir by varying the fault orientation and size, hydraulic conductivity of the faulted zone, initial vertical and horizontal stress state and Mohr-Coulomb parameters (i.e., friction angle and cohesion). References: [1] Ferronato, M., G. Gambolati, C. Janna, and P. Teatini (2008), Numerical modeling of regional faults in land subsidence prediction above gas/oil reservoirs, Int. J. Numer. Anal. Methods Geomech., 32, 633-657.
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