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Poromechanics modeling of fault stability under the influence of fluid pressure changes ZHIBING YANG, RUBEN JUANES, Massachusetts Inst of Tech-MIT — Fluid injection in a faulted geologic formation can induce slip failure and trigger seismicity. The governing mechanisms are generally explained by the effective stress principle. But it remains unclear how to describe the criterion for the onset of slip failure of preexisting faults in the presence of pore pressure changes. Here we provide a micromechnics perspective by numerical modeling. We first develop a model coupling a discrete element method (for the mechanics of the solid matrix) and pore-network single-phase flow. Pore pressure provides tractions on the solid grains, changing the mechanical response of the solid material. The fluid pressure distribution is solved via an explicit scheme, taking into account the effect of deformation of the solid matrix. We demonstrate the ability of the two-way coupled poromechanic model to reproduce rock deformation behavior measured in triaxial laboratory tests under the influence of pore pressure. We then study the fault stability in the case of a preexisting impermeable fault, across which there exist a pressure discontinuity due to fluid injection on one side. Numerical results are discussed with a focus on the fault stability criterion and the slip behavior.

Zhibing Yang
Massachusetts Inst of Tech-MIT

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