

MODELING GEOMECHANICS OF FAULTS AND FRACTURES

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ABSTRACT

Numerical modelling of faulted and fractured media mechanics is an emerging area of research. The possible activation of existing faults or the generation of new fractures is an issue that is receiving an increasing attention especially in the oil and gas industry, where the accurate prediction of complex subsurface processes is of paramount importance from both an economical and environmental point of view. For example, the reactivation of faults can trigger/induce seismic and micro-seismic activity that must be carefully taken into consideration when planning either the development of new fields or the management of depleted reservoirs for underground gas storage. On the other hand, the generation of fractures caused by the injection of fluids at high pressures is one of the most effective strategies for enhancing the oil/gas production from low permeable formations, e.g. shale gas. The numerical models currently available for the accurate simulation of the mechanical behaviour of faults and fractures are still far from being well-consolidated. Faults can be simulated using the basic concepts of contact mechanics, for example by a penalty or an augmented lagrangian formulation. This kind of approach may yield severely ill-conditioned problems that must be treated with much care from a numerical point of view. An alternative approach is a continuous one where faults are simulated as thin structures characterized by a constitutive law based on a Mohr-Coulomb or Drucker-Prager elasto-plastic behavior different from the rock hosting the discontinuity. Moreover, in some cases hydro-mechanical coupling can be also important, thus requiring the simultaneous simulation of fluid-dynamics and geomechanics. Predicting the generation of new fractures is also important, with this task often accomplished by either non-linear approaches coupled with expensive re-meshing techniques or continuous approaches based on the damage theory.

This mini-symposium aims at providing a forum for the presentation and discussion of the most advanced numerical techniques currently used for simulating the geomechanics of faults and fractures, with experts and researchers from all over the world to share experiences, challenges and ideas. Applications to real-world problems are welcome, especially, but not exclusively, related to the oil and gas industry.