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RECENT ADVANCES IN THE NUMERICAL SIMULATION OF HYDRAULIC FRACTURE GROWTH

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ABSTRACT

Hydraulic fracturing is a key technology for the recovery of hydrocarbons from low permeability reservoir (unconventional oil and gas fields). It is also used in the development of enhanced geothermal systems and to precondition block caving operations in mines to reduce seismicity. Hydraulic fractures also occur naturally as magma pressurize the crust and drive buoyant fractures, or due to fluid discharge beneath glaciers.

The multiple time and length scales resulting from the coupling between the mechanical deformation and fluid flow inside the fracture are well known to cause significant challenges to the numerical solution of the moving boundary problem associated with fracture growth [1, 2]. The knowledge of the multiscale structure of the near-tip behaviour has made it possible to develop very accurate numerical scheme in recent years [3, 4] for planar hydraulic fractures driven by Newtonian or Power-law fluids. In addition, the coupling with the transport of particles, that are added to prevent fracture closure, introduces an extra challenge for modelling.

The objective of this mini-symposium is to discuss the recent advancements in the numerical analysis of hydraulic fracturing and related processes, with a particular focus on high

performance simulations in terms of both accuracy and computational cost. The authors are invited to submit their contribution to this mini-symposia under the following topics:

1. Novel solution strategies for solid-fluid coupling, fracture propagation and fluid flow in newly created fracture networks and porous media.
2. Innovative discretization methods, e.g. XFEM, phase-field, hybrid Finite Elements and Boundary Elements.
3. Acceleration techniques, such as massive parallelization, domain decomposition and model order reduction. This also includes using reduced models, such as pseudo-3D or other approaches to achieve rapid calculations.
4. Three dimensional aspects, interactions with pre-existing natural fractures and bedding interfaces, and also with fractures from other stages and wells.
5. Comparisons between numerical predictions and laboratory experiments.
6. Numerical schemes for modelling fracture growth coupled with other phenomena, such as with thermal effects or with proppant transport.

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