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# A generalised phase-field model for fluid-driven dynamic fracture propagation in porous media

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Hydro-mechanical coupling in deforming porous media has been the subject of studies in mechanical, energy, geology and environmental engineering. In our work, following Griffith's theory [1] and Francfort and Marigo's [2] variational approach to fracture, we develop a generalised phase-field-based formulation for predicting the fluid-driven fracture propagation in porous media across different time scales. The advantage of the phase-field method is that the complex fracture behaviour, such as initiation, propagation, branching and merging, is the natural outcome of simulations without prior knowledge of propagation path. A macroscopic framework is proposed for phase-field modelling of dynamic fracture to couple the physics of flow with the mechanics of fracture, including the deformation behaviour of solid skeleton, the crack propagation and fluid flow within pores and cracks. The effect of fluid properties such as viscosity and permeability is also discussed. The numerical algorithm is implemented in ABAQUS by user-defined subroutines. We compare numerical results against several analytical and experimental solutions and also demonstrate the approach's ability to predict complex fluid-driven fracture systems.
[1] Griffith Alan Arnold & Taylor Geoffrey Ingram. The phenomena of rupture and flow in solids. Philosophical Transactions of the Royal Society of London. Series A, Containing Papers of a Mathematical or Physical Character 221, 163–198 (1921).
[2] Francfort, G. A. & Marigo, J.-J. Revisiting brittle fracture as an energy minimization problem. Journal of the Mechanics and Physics of Solids 46, 1319–1342 (1998).

## Participation

In-Person

## References

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