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A six (+1) field formulation for flow in porous media with fractures and barriers

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A domain decomposition approach for flow simulations in poro-fractured media using non-conforming meshes is presented. Fractures in a porous medium can either act as preferential flow path, either represent barriers for the flow. When a geometrical reduction approach is used, as, e.g. in a Discrete Fracture and Matrix (DFM) model, fractures are represented as planar interfaces embedded in a three dimensional porous matrix. A formulation with six independent pressure variables and an additional field for the flux at fracture intersections is proposed to de-couple the problems on each fracture and in the bulk domain. A suitable cost functional is then minimized to recover the global solution. Each field can be discretized independently from the others, and on an independently built mesh. As the pressure solution in the porous matrix can be discontinuous across barrier interfaces, the eXtended Finite Element method with discontinuous enrichment functions is used to describe this kind of irregular behavior on a mesh non conforming to the irregularity interface.
The proposed approach has the advantage of a strong robustness to geometrically complex configuration and allows to take advantage of parallel computing techniques.

Participation

In-Person

References

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