# Multiscale discretizations for multiphase porous media flow coupled with geomechanics

Multiscale modeling and simulation of multiphase flow coupled with geomechanics

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*Abstract*

We consider numerical modeling of the system of poroelasticity, which describes fluid flow in deformable porous media. The focus is on locally mass conservative discretizations that provide efficient and accurate multiscale approximations on rough grids and for highly heterogeneous media. The flow equations are discretized by a multiscale mortar finite element method. The equations in the coarse elements (or subdomains) are discretized on a fine grid scale by a multipoint flux mixed finite element method that reduces to cell-centered finite differences on irregular grids. The subdomain grids do not have to match across the interfaces. Continuity of flux between coarse elements is imposed via a mortar finite element space on a coarse grid scale. With an appropriate choice of polynomial degree of the mortar space, optimal order convergence is obtained for the method on the fine scale. The algebraic system is reduced via a non-overlapping domain decomposition to a coarse scale mortar interface problem that is solved efficiently using a multiscale flux basis.

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