A multipoint stress mixed finite element method for elasticity

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Abstract

We develop a new mixed finite element method for linear elasticity model with weakly enforced symmetry on both simplicial and quadrilateral grids. Motivated by the multipoint flux mixed finite element method for flow in porous media, we consider a special quadrature rule that allows for elimination of stress and rotation variables and leads to a cell-centered system for the displacements. Theoretical and numerical results indicate first-order convergence for all variables in the natural norms.

We also discuss the numerical approximation of the system of poroelasticity, which describes fluid flow in deformable porous media. The flow part of the proposed model is governed by the Darcy equation, while we adopt the mixed formulation for the elasticity equation for the further usage of the multipoint stress mixed finite element method.

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