Mixed-Dimensional Modeling for Flow in Fractured Porous and Poroelastic Media

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Abstract

We consider fluid flow in porous and poroelastic media containing thin heterogeneities such as debris-filled fractures. When the fracture aperture is sufficiently small, it is natural to model fractures as lower-dimensional manifolds embedded in the bulk medium, leading to discrete fracture models at the Darcy scale. The fracture's material parameters, such as hydraulic conductivity and elasticity, are assumed to scale with powers of the width-to-length ratio ε of the fracture. Based on a priori estimates, we rigorously derive limit models as $\varepsilon \to 0$ and identify different limit regimes [1, 2]. We illustrate our results with numerical experiments based on discontinuous Galerkin discretizations.

References

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