A Lagrange multiplier method for flow in fractured poroelastic media

Ilona Ambartsumyan^{*} Eldar

Eldar Khattatov^{*} Ivan Yotov^{*}

Paolo Zunino[‡]

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Abstract

We study the finite element computational model for solving coupled problem arising in the interaction between a poroelastic material and a fracture filled with fluid. The fluid flow in fracture is governed by the Stokes equation for an incompressible fluid, while the poroelastic material is modeled using the Biot system. The appropriate equilibrium and kinematic conditions are imposed on the interface. The focus is made on the approximation of the interface conditions, which feature the interaction of different variables. The Lagrange multiplier method is used to enforce these non standard interface conditions. After performing the stability and error analysis, a series of numerical experiments were done in order to study the convergence rates, the applicability of the method to modeling physical phenomena and sensitivity of the model with respect to its parameters.

^{*}Department of Mathematics, University of Pittsburgh, Pittsburgh, PA 15260, USA; { ila6@pitt.edu, elk58@pitt.edu, yotov@math.pitt.edu}.

[†]Department of Mechanical Engineering & Materials Science, Pittsburgh, PA 15261, USA; { paz13@pitt.edu}.