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Aycil Cesmelioglu

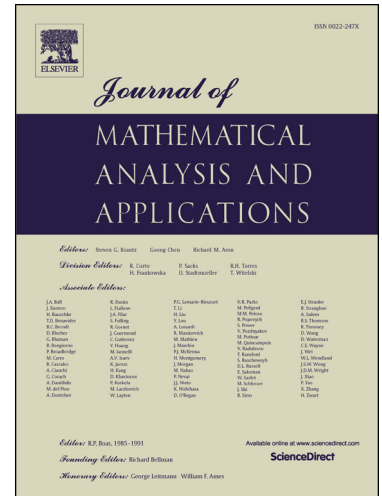
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Analysis of the coupled Navier-Stokes/Biot problem

Aycil Cesmelioglu

*Oakland University, Department of Mathematics and Statistics, 146 Library Drive,
Rochester, MI 48309*

Abstract

We analyze a weak formulation of the coupled problem defining the interaction between a free fluid and a poroelastic structure. The problem is governed by the time-dependent incompressible Navier-Stokes equations and the Biot equations. Under a small data assumption, existence and uniqueness results are proved and a priori estimates are provided.

Keywords: Navier-Stokes, Darcy, Biot, poroelastic, weak formulation, existence

2010 MSC: 35Q30, 35Q35

1. Introduction.

We consider a fully dynamic model for the interaction of an incompressible Newtonian fluid with a poroelastic material where the boundary is assumed to be fixed. The fluid flow is governed by the time-dependent incompressible Navier-Stokes equations. For the poroelastic material we use the Biot system with appropriate flow and stress couplings on the interface between the fluid and the poroelastic regions. This problem is a fully dynamic coupled system of mixed hyperbolic-parabolic type and inherits all the difficulties mathematically and numerically involved in the standard fluid-structure interaction and Stokes/Navier-Stokes-Darcy coupling.

The literature is rich in works on related coupled problems and here we provide only a partial list of relevant publications. One related problem deals with the interaction of an incompressible fluid with a porous material and modeled by the coupling of the Stokes/Navier-Stokes equations to the Darcy

Email address: cesmelio@oakland.edu. (Aycil Cesmelioglu)

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