

A Navier-Stokes-Darcy Hemivariational Inequality

Stanisław Migórski

The paper deals with the existence of weak solution to the steady-state Navier-Stokes-Darcy model for an incompressible fluid in a bounded domain. The no-leak boundary condition and a multivalued nonmonotone slip condition of “friction type” is assumed. The latter is governed by the generalized subgradient of a locally Lipschitz superpotential. The transmission conditions across the interface boundary involve the balance of normal forces described by the Lions condition, and the Navier slip condition formulated as the Beavers-Joseph-Saffman law. We formulate the boundary-value problem as a hemivariational inequality of elliptic type for the Navier-Stokes velocity and the Darcy pressure. We employ a method based on a surjectivity results for a pseudomonotone coercive operator in a reflexive Banach space. The existence of a weak solution under suitable assumptions involving a smallness condition is proved. The recovery of the classical model from the hemivariational inequality is demonstrated.

First Author: Stanisław, Migórski

Affiliation: *Faculty of Mathematics and Computer Science, Jagiellonian University
in Krakow
30-348, Poland*

e-mail: stanislaw.migorski@uj.edu.pl