

A mixed finite element method for the coupling of fluid flow with porous media flow

S. MEDDAHI

Dpto. de Matemáticas, Univ. de Oviedo

salim@uniovi.es

G.N. GATICA, R. OYARZÚA

Dpto. de Ingeniería Matemática, Univ. de Concepción, Chile

ggatica@ing-mat.udec.cl, royarzua@ing-mat.udec.cl

Resumen

We consider a porous media entirely enclosed within a fluid region, and present a well posed conforming mixed finite element method for the corresponding coupled problem. The interface conditions refer to mass conservation, balance of normal forces, and the Beavers-Joseph-Saffman law, which yields the introduction of the trace of the porous media pressure as a suitable Lagrange multiplier. The finite element subspaces defining the discrete formulation employ Bernardi-Raugel and Raviart-Thomas elements for the velocities, piecewise constants for the pressures, and continuous piecewise linear elements for the Lagrange multiplier. We show stability, convergence, and a priori error estimates for the associated Galerkin scheme.

Sección en el CEDYA 2007: AN

Referencias

- [1] G. Beavers and D. Joseph, *Boundary conditions at a naturally impermeable wall*. Journal of Fluid Mechanics, 30, (1967), 197-207.
- [2] C. Bernardi, F. Hecht, and O. Pironneau, *Coupling Darcy and Stokes equations for porous media with cracks*. Mathematical Modelling and Numerical Analysis, 39, (2005), 7-35.
- [3] W. Jäger and M. Mikelić, *On the interface boundary condition of Beavers, Joseph, and Saffman*. SIAM Journal on Applied Mathematics, 60, (2000), 1111-1127.
- [4] W.J. Layton, F. Schieweck, and I. Yotov, *Coupling fluid flow with porous media flow*. SIAM Journal on Numerical Analysis, 40, (2003), 2195-2218.
- [5] B. Riviere and I. Yotov, *Locally conservative coupling of Stokes and Darcy flows*. SIAM Journal on Numerical Analysis, 42, (2005), 1959-1977.