STABILIZED MIXED FINITE ELEMENT APPROXIMATION OF AXISYMMETRIC BRINKMAN FLOWS

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ABSTRACT. This paper is devoted to the numerical analysis of an augmented finite element approximation of the axisymmetric Brinkman equations. Stabilization of the variational formulation is achieved by adding suitable Galerkin least-squares terms, allowing us to transform the original problem into a formulation better suited for performing its stability analysis. The sought quantities (here velocity, vorticity, and pressure) are approximated by Raviart-Thomas elements of arbitrary order $k \geq 0$, piecewise continuous polynomials of degree $k+1$, and piecewise polynomials of degree k, respectively. The well-posedness of the resulting continuous and discrete variational problems is rigorously derived by virtue of the classical Babuška–Brezzi theory. We further establish a priori error estimates in the natural norms, and we provide a few numerical tests illustrating the behavior of the proposed augmented scheme and confirming our theoretical findings regarding optimal convergence of the approximate solutions.

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