



Seminario de Estudiantes de Postgrado en Ingeniería Matemática

Sesión 3 – 2026

Martes 22 de septiembre, 12:30 horas, auditorio Hermann Alder Weller, CI²MA

A Banach space mixed formulation for the unsteady Brinkman problem with varying porosity

We propose and analyze a new mixed formulation for the time-dependent Brinkman equations with spatially varying porosity, modeling incompressible flow through heterogeneous porous media. The formulation introduces the stress and vorticity tensors as additional unknowns, leading to a stress-velocity-vorticity system in which the pressure is recovered by post-processing. The well-posedness of the continuous problem is established under an appropriate small-porosity assumption by combining monotone operator techniques, fixed-point theory, and recent results on perturbed saddle-point problems in Banach spaces. For the spatial discretization, we introduce a semidiscrete scheme based on finite element spaces stable for elasticity, for which we prove well-posedness and derive optimal *a priori* error estimates. The fully discrete scheme is obtained by applying the backward Euler method for the time discretization, and its well-posedness and optimal convergence rates are also established. Numerical experiments in two and three dimensions confirm the theoretical convergence rates and demonstrate the ability of the method to handle challenging heterogeneous media with strong contrasts in permeability and porosity

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