SEMINARIO DE ANÁLISIS NUMÉRICO Y MODELACIÓN MATEMÁTICA

Departamento de Matemática, UBB

Centro de Investigación en Ingeniería Matemática (CI^{2}MA), UDEC

Expositor:

Sergio Caucao

Departamento de Matemática, Universidad del Bío-Bío

Título de la Charla:

Analysis of a mixed-FEM for the pseudostress-velocity formulation of the Stokes problem with varying density

Fecha y Hora:
Miércoles 9 de Octubre de 2013, 16:30 Horas.

Lugar:
Auditorio Alamiro Robledo, FCFM
Universidad de Concepción.

Resumen

We propose and analyze a mixed finite element method for the nonstandard pseudostress-velocity formulation of the Stokes problem with varying density ρ in $\mathbb{R}^d$, $d \in \{2, 3\}$. Since the resulting variational formulation does not have the standard dual-mixed structure, we reformulate the continuous problem as an equivalent fixed-point problem. Then, we apply the classical Babuška-Brezzi theory to prove that the associated mapping $\mathbb{T}$ is well defined, and assuming that $\|\frac{\nabla\rho}{\rho}\|_{\mathbf{L}^\infty(\Omega)}$ is sufficiently small, we show that $\mathbb{T}$ is a contraction mapping, which implies that the variational formulation is well posed. Under the same hypothesis on ρ we prove stability of the continuous problem. Next, adapting the arguments of the continuous analysis to the discrete case, we are able to establish suitable hypotheses on the finite element subspaces ensuring that the associated Galerkin scheme becomes well posed. A feasible choice of subspaces is given by Raviart-Thomas elements of order $k \geq 0$ for the pseudostress and polynomials of degree k for the velocity. Finally, a numerical result, illustrating the good performance of the method with a specific choice of discrete spaces, and confirming the theoretical rate of convergence, is provided.