



SEMINARIO DEL DEPARTAMENTO DE MATEMÁTICA Y FÍSICA APLICADAS  
FACULTAD DE INGENIERÍA

---

**Mathematical and numerical analysis for a family of parabolic mixed equations: applications to the eddy current model**

**Dr. Ramiro Acevedo**  
Departamento de Matemáticas  
Universidad del Cauca - Colombia

**Resumen**

The aim of this work is to show an abstract framework to analyze a family of linear degenerate parabolic mixed equations and its fully-discrete approximation by using a backward Euler discrete scheme for the time-derivatives. We combine the theory for the degenerate parabolic equations [6] with the classical Babuska-Brezzy theory to deduce necessary and sufficient conditions to prove the well-posedness for both problems. Next, we show two mixed finite element formulations which arise from electromagnetic applications [1,2] and deduce their well-posedness by using the developed abstract theory. Finally, we give general and sufficient conditions for the convergence of the approximation, which are satisfied by the applications previously mentioned. The main results of this talk can be found in [3]. Other studies on mixed parabolic problems are presented in [4,5].

Trabajo en conjunto con Christian Gómez y Bibiana López-Rodríguez.

**Bibliografía**

- [1 ] R. Acevedo, S. Meddahi, and R. Rodríguez. An  $E$ -based mixed formulation for a time-dependent eddy current problem. Mathematics of Computation, **78**, 1929–1949 (2009).
- [2 ] R. Acevedo and S. Meddahi. An  $E$ -based mixed FEM and BEM coupling for a time-dependent eddy current problem IMA Journal of Numerical Analysis, **31**(2), 667–697 (2011).
- [3 ] R. Acevedo, Ch. Gómez, and B. López-Rodríguez. Finite element approximation for a family of a degenerate parabolic mixed equations and its application to the eddy current problem. In preparation.
- [4 ] C. Bernardi and G. Raugel, A conforming finite element method for the time-dependent Navier-Stokes equations, SIAM J. Numer. Anal., **22** (1985), pp. 455–473.
- [5 ] D. Boffi and L. Gastaldi, Analysis of finite element approximation of evolution problems in mixed form, SIAM J. Numer. Anal., **42** (2004), pp. 1502–1526.
- [6 ] R.E. Showalter. Monotone Operators in Banach Space and Nonlinear Partial Differential Equations. Math. Surveys Monogr., vol. 49, Amer. Math. Soc., Providence, RI (1997).

**Martes 22 de Agosto de 2017, 16 : 20 horas**  
**Auditorio San Agustín (Facultad de Ingeniería)**

---

**Coordinadores:**

Johanna García, Departamento de Matemática y Física Aplicadas, jgarcias@ucsc.cl  
Tomás Barrios, Departamento de Matemática y Física Aplicadas, tomas@ucsc.cl