

SEMINAR

Grupo de Análise Funcional e Aplicações Functional Analysis and Applications Group

Numerical Analysis of Wave-Parabolic Systems with Application to Drug Delivery

Daniela Jordão
Universidade de Coimbra, CMUC

Abstract

Ultrasound enhanced drug transport is a multiphysics problem that involves acoustic waves propagation, bioheat transfer, and drug transport. The numerical modeling of this problem requires the solution of a coupled system of partial differential equations. A wave-type equation for acoustic pressure and two nonlinear parabolic-type equations: a diffusion-reaction equation for bioheat transfer and a convection-diffusion-reaction equation for drug transport.

In this talk we will be focused in the study of the numerical analysis of such coupled system. We propose and derive convergence estimates for a piecewise linear finite element method (FEM) with quadrature. We prove that the FEM is second order convergent for concentration with respect to a discrete L^2 -norm. Since concentration depends on the gradient of acoustic pressure, this result shows that the FEM is superconvergent. In fact, piecewise linear FEM have optimal order one in the H^1 -norm then, the optimal convergence rate for concentration in a L^2 -norm should be at most one. Numerical results backing the theoretical findings are included.

Room Sousa Pinto
October 28, 2020 - 15:10

This seminar is supported in part by the Portuguese Foundation for Science and Technology (FCT - Fundação para a Ciência e a Tecnologia), through CIDMA - Center for Research and Development in Mathematics and Applications, within project UIDB/04106/2020.