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Adjoint method for a tumour invasion PDE-constrained optimization problem using FEM

In this talk we present a method for estimating unknown parameters that appear on a non-linear reaction-diffusion model of cancer invasion. This model considers that tumor-induced alteration of micro-enviromental pH provides a mechanism for cancer invasion. A coupled system reaction-diffusion describing this model is given by three partial differential equations for the non dimensional spatial distribution and temporal evolution of the density of normal tissue, the neoplastic tissue growth and the excess concentration of H+ ions. Each of the model parameters has a corresponding biological interpretation. For instance, the growth rate of neoplastic tissue, the diffusion coefficient. After solving the forward problem properly, we use the model for the estimation of parameters by fitting the numerical solution with real data, obtained via in vitro experiments and medical imaging. We define an appropriate functional to compare both the real data and the numerical solution. We use the adjoint method for the minimization of this functional and Finite element method to solve both the direct and inverse problem, computing the posterior error in both problem. Moreover, we show some ideas about the possibilities of a therapeutic methodology in order to treat the tumor.