Optimization problems that arise in complex systems and tumor growth

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In this work we will address two optimization problems that arise in complex systems and tumor growth. For the case of complex systems we use a kinetic model to simulate wealth distribution in a society. Kinetic models have so far been used to model wealth distribution in a society. In particular, within the framework of the kinetic theory for active particles, some important models have been developed and proposed. They involve nonlinear interactions among individuals that are modeled according to game theoretical tools by introducing parameters governing the temporal dynamics of the system. We propose an approach based on optimal control tools that aims to optimize this evolving dynamics from a social point of view. Namely, we look for time dependent control variables concerning the distribution of wealth that can be managed, for instance, by the government, in order to obtain a given social profile. On the other hand, we present a method for estimating an unknown parameter that appears in a two dimensional non-linear reaction-diffusion model of cancer invasion. This model considers that tumor-induced alteration of micro-environmental pH provides a mechanism for cancer invasion. A coupled system reaction-diffusion describing this model is given by three partial differential equations for the 2D non-dimensional spatial distribution and temporal evolution of the density of normal tissue, the neoplastic tissue growth and the excess H^+ ion concentration. The parameter is estimated by solving a minimization problem, in which the objective function is defined in order to compare both the real data and the numerical solution of the cancer invasion model.