

THEORETICAL AND NUMERICAL APPROACHES OF REACTION COEFFICIENTS IDENTIFICATION IN REACTION-DIFFUSION SYSTEMS ARISING IN EPIDEMIOLOGY

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ABSTRACT

We introduce the necessary conditions for the existence and uniqueness of reaction coefficient determination problem in a class of reaction-diffusion systems from a knowledge of an approximation of the state variables at the end of the processes. The system considered is a generalization of the susceptible-infected-susceptible (SIS) model disease transmission under the assumption of spatial displacement of the population. We introduce a formulation of the inverse problem as a constrained optimization problem for an appropriate cost functional. We introduce and prove seven results: the existence and uniqueness of strong global solutions for the direct problem, the existence of a minimizer for the cost functional, the boundness of solutions for the adjoint problem, a first-order necessary optimality condition, the continuous dependence of direct problem solution with respect to the reaction coefficients, the continuous dependence of the adjoint problem solution with respect to the reaction coefficients and observation functions, and the uniqueness of the inverse problem up an additive constant. In addition, we introduce a numerical approach to the inverse problem in the case of the parameter identification problem and consider some numerical examples.

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