

Asymptotic Analysis for a nonlinear Reaction-Diffusion System Modeling an Infectious Disease

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Abstract

In this paper we study a nonlinear reaction-diffusion system which models an infectious disease caused by bacteria such as cholera. One of the features in this model is that a certain portion of the recovered human hosts lost a lifetime immunity and could be infected again. Another feature in the model is that the mobility for each species is assumed to be dependent upon location and time. We also assume that the whole group is susceptible with the bacteria. This leads to a strongly coupled nonlinear reaction-diffusion system. We prove that the nonlinear system has a unique solution globally in any space dimension under some natural conditions on known parameters and functions. Moreover, the long-time behavior and stability analysis for the solution are carried out rigorously. In particular, we characterize the precise conditions on variable parameters about the stability or instability for all steady-state solutions. These results obtained in this paper answered several open questions raised in the previous literature

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