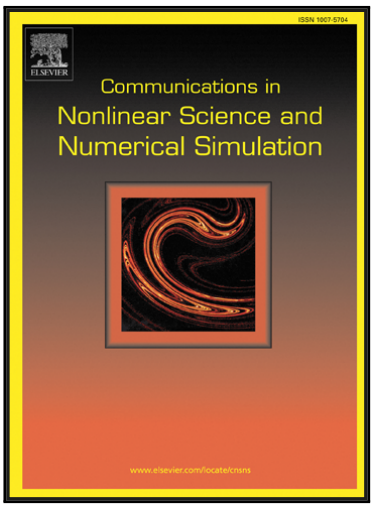

The stationary distribution and ergodicity of a stochastic phytoplankton allelopathy model under regime switching

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The stationary distribution and ergodicity of a stochastic phytoplankton allelopathy model under regime switching ☆

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Abstract

The effect of toxin-producing phytoplankton and environmental stochasticity are interesting problems in marine plankton ecology. In this paper, we develop and analyze a stochastic phytoplankton allelopathy model, which takes both white and colored noises into account. We first prove the existence of the global positive solution of the model. And then by using the stochastic Lyapunov functions, we investigate the positive recurrence and ergodic property of the model, which implies the existence of a stationary distribution of the solution. Moreover, we obtain the mean and variance of the stationary distribution. Our results show that both the two kinds of environmental noises and toxic substances have great impacts on the evolution of the phytoplankton populations. Finally, numerical simulations are carried out to illustrate our theoretical results.

Keywords: Ecotoxicology, Phytoplankton allelopathy, Stochastic disturbance, Markov chain, Stationary distribution, Ergodicity

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