

Lyapunov Functional for a Class of Multi-Species Models with Cross Diffusion

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In this work, we study a class of models of the interaction of N species ($N > 2$) which involves cross diffusion. This class generalizes the model introduced in 1979 by Shigesada, Kawasaki and Teramoto for two species (SKT). All species are assumed to exhibit a functional response of the same form similar to SKT model. Lyapunov functional of the system is constructed under some assumptions for the cross-diffusion matrix and the diffusion vector. The global stability of the constant equilibrium is proved by using this Lyapunov functional. Further, sufficient conditions for the coexistence of a large number of interacting species are derived. Particular cases of the models for two and three species are considered extensively in the literature. Known results for these models are shown to follow as consequences of the general theory developed here.