

The Existence and Stability of Travelling Waves with Transition Layers for Some Cross-Diffusion Systems

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It's a joint research work with X.Zhao (Capital Normal Univ. China).

We are concerned with a class of quasilinear cross-diffusion systems describing two competition species or predator-prey model under self and cross population pressure.

$$\begin{cases} u_t = \epsilon^2[(1 + \beta_1 u + \gamma_1(\epsilon)v)u]_{xx} + f(u, v), \\ v_t = [(1 + \epsilon\gamma_2(\epsilon)u + \beta_2 v)v]_{xx} + g(u, v). \end{cases} \quad (1)$$

Under some abstract assumption on f and g , for small $\epsilon > 0$, the existence of travelling waves with transition layers can be obtained, which extends the results of M.Mimura, Y. Hosono and A. Gardner for some non cross-diffusion models to the more general systems with cross-diffusion.

Applying the stability index method (the first chern number) to the more general eigenvalue problem induced by the quasilinear cross-diffusion systems, by spectral and topological analysis, the travelling waves with transition layers for the cross-diffusion systems are proved to be locally stable, which also extends the results of C.Jones and A. Gardner to the more general systems.

In this talk, we shall focus on the related biological models, the structure of the travelling waves with transition layers, the effect of cross-diffusion, and the application of the stability index method.