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Zhifu Xie* (zxie@vsu.edu), Department of Mathematics & Computer Science, P.O. Box 9068, Virginia State University, Petersburg, VA. *Cross-diffusion induced Turing instability for a three species food chain model*. Preliminary report.

In a reaction-diffusion system, diffusion can induce the instability of a uniform equilibrium which is stable with respect to a constant perturbation, as shown by Turing in 1950s. We study a strongly coupled reaction-diffusion system describing three interacting species in a food chain model, where the third species preys on the second one and simultaneously the second species preys on the first one. We first show that the positive equilibrium solution is globally asymptotically stable for the corresponding ODE system. The positive equilibrium solution remains linearly stable for the reaction diffusion system without cross diffusion, hence it does not belong to the classical Turing instability scheme. But it becomes linearly unstable only when cross-diffusion also plays a role in the reaction-diffusion system, hence the instability is driven solely from the effect of cross diffusion. (Received September 15, 2010)