

Instability and blowup phenomena induced by diffusion in some reaction-diffusion-ODE systems

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We consider mathematical models of a pattern formation arising in processes described by a system of a single reaction-diffusion equation coupled with an ordinary differential equation. This type of models exhibits the diffusion-driven instability, and it is expected that non-constant stationary solutions exist and some spatially inhomogeneous solutions converge toward them.

First, we shall discuss the instability of inhomogeneous stationary solutions. It will be shown that a certain natural (autocatalysis) property of a system leads to instability of all inhomogeneous stationary solutions. Next, we shall discuss a possible large time behavior of solutions. The system can be reduced to a simple model, so called the shadow system, and we will see that space inhomogeneous solutions of the shadow system become unbounded in either finite or infinite time, even if space homogeneous solutions are bounded uniformly in time.

These are joint works with Anna Marciniak-Czochra (University of Heidelberg) and Grzegorz Karch (University of Wrocław).