

Instability for a Reaction-Diffusion System with Obstacles

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Turing's idea for morphogenesis bases on the concept of a stable equilibrium of two chemicals which is destabilized by diffusion. Unfortunately, this idea requires that the diffusion speeds are extremely asymmetric, which is a debatable assumption. It is explained, heuristically, why in the presence of unilateral obstacles which can easily occur in biological models (e.g. a certain source for the inhibitor) this asymmetry might not be necessary. Moreover, mathematically rigorous results are presented which prove this phenomenon in a rather quantitative way in terms of bifurcation of stationary patterns and in terms of a lack of stability. Since the problem involves non-differentiable operators, it is natural to employ topological methods (e.g. degree theory) for the proofs.