Unilateral sources of an activator in reaction-diffusion systems describing Turing's patterns

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Abstract

A reaction-diffusion system exhibiting Turing's diffusion driven instability is considered. The equation for activator is supplemented by unilateral terms of the type $s_-(\mathbf{x})u^-$, $s_+(\mathbf{x})u^+$ describing sources and sinks active only if the concentration decreases below and increases above, respectively, the value of the basic spatially constant solution which is shifted to zero. We show that the domain of diffusion parameters in which spatially non-homogeneous stationary solutions can bifurcate from that constant solution is smaller than in the classical case without unilateral terms. It is a dual information to previous results stating that analogous terms in the equation for inhibitor imply the existence of bifurcation points even in diffusion parameters for which bifurcation is excluded without unilateral sources. The case of mixed (Dirichlet-Neumann) boundary conditions as well as that of pure Neumann conditions is described.