

Curvature effects in pattern formation: analysis and control of a sixth-order Cahn–Hilliard equation

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In this talk, the well-posedness and optimal control are discussed for a sixth-order Cahn–Hilliard system, which represents a higher-order variant of the well-known Cahn–Hilliard equation. In our system, the evolution equation is complemented with a source term, where the control variable enters as a distributed mass regulator. The presence of further spatial derivatives in the sixth-order formulation enables the model to capture curvature effects, for a more accurate description of isothermal phase separation dynamics in complex materials systems. A well-posedness result for the initial-boundary value problem is shown when assuming a smooth double-well potential as part of the free energy. Then, the related optimal control problem is addressed. Existence of optimal controls is established, and the first-order necessary optimality conditions are characterized via a suitable variational inequality involving the solution to the adjoint problem. These results have been obtained in a recent collaboration with G. Gilardi (University of Pavia), A. Signori (Polytechnic of Milan) and J. Sprekels (WIAS Berlin).