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Numerical Solution of vector-valued phase field equations
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Vector-valued phase field models play a prominent role in many practical applications such as grain boundary motion (non-conserved order parameter) or phase separation of multicomponent alloys. While the analysis and numerical analysis of vector-valued phase field equations is in a good shape, the fast solution of the resulting discrete algebraic systems is still in its infancy. We present novel multigrid methods for Allen-Cahn equations and nonsmooth Schur-Newton methods for Cahn-Hilliard equations with logarithmic potential. Global convergence is based on convex minimization rather than smoothness which leads to robustness with respect to temperature as ranging from the shallow quench to the deep quench limit. Our theoretical considerations are illustrated by numerical experiments.