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Recent results on phase-field systems with nonlocal interactions

We consider a phase field model of Caginalp type where nonlocal interactions are not locally approximated. The resulting evolution system consists of the energy balance equation coupled with a nonlinear and nonlocal ODE for the order parameter. Such system has been analyzed by several authors, in particular when the configuration potential is a smooth double-well function. Here we consider both the case of standard regular potentials as well as the case of physically realistic singular (e.g., logarithmic) potentials. We present well-posedness results and the eventual global boundedness of solutions uniformly with respect to (rather general) initial data. Also, we show that the separation property holds in the case of singular potentials. Finally, thanks to such results, we can establish the existence of a finite-dimensional global attractor. Some open issues will also be discussed.