Front propagation in geometric and phase field models of stratified media

Cyrill Muratov
New Jersey Institute of Technology

We study front propagation problems for forced mean curvature flows and their phase field variants that take place in stratified media, i.e., heterogeneous media whose characteristics do not vary in one direction. We consider phase change fronts in infinite cylinders whose axis coincides with the symmetry axis of the medium. Using the recently developed variational approaches, we provide a convergence result relating asymptotic in time front propagation in the diffuse interface case to that in the sharp interface case, for suitably balanced nonlinearities of Allen-Cahn type. The result is established by using arguments in the spirit of Γ-convergence, to obtain a correspondence between the minimizers of an exponentially weighted Ginzburg-Landau-type functional and the minimizers of an exponentially weighted area-type functional. These minimizers yield the fastest moving traveling waves in the respective models and determine the asymptotic propagation speeds for front-like initial data. We further show that generically these fronts are the exponentially stable global attractors for this kind of initial data and give sufficient conditions under which complete phase change occurs via the formation of the considered fronts.