A convective bulk-surface Cahn–Hilliard model with singular potentials

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We consider a general class of convective bulk-surface Cahn–Hilliard systems with singular potentials. In contrast to classical Neumann boundary conditions, the dynamic boundary conditions of Cahn–Hilliard type allow for dynamic changes of the contact angle between the diffuse interface and the boundary, a convection-induced motion of the contact line as well as absorption of material by the boundary. The coupling conditions for bulk and surface quantities involve parameters $K, L \in [0, \infty]$, whose choice declares whether these conditions are of Dirichlet, Robin or Neumann type.

In this talk, I present some recent results on the well-posedness of this system for singular potentials. We make use of the Yosida approximation to regularise these potentials which allows us to apply the results for regular potentials and eventually pass to the limit in this approximation scheme to obtain a global-in-time weak solution. Afterwards, under additional assumptions on the mobility functions and the velocity fields, we use standard difference-quotient arguments and regularity theory for elliptic systems with bulk-surface coupling to prove the existence of a unique global-in-time strong solution. These higher regularity results can then be used to establish separation properties of the phase-fields.

This is based on joint work with Patrik Knopf.