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Choosing the velocity as control in a nonlocal convective Cahn-Hilliard equation

In this talk I will present a distributed optimal control problem for a nonlocal convective Cahn–Hilliard equation with degenerate mobility and singular potential in three dimensions of space. While the cost functional is of standard tracking type, the control problem under investigation cannot easily be treated via standard techniques for two reasons: the state system is a highly nonlinear system of PDEs containing singular and degenerating terms, and the control variable, which is given by the velocity of the motion occurring in the convective term, is nonlinearly coupled to the state variable. The latter fact makes it necessary to state rather special regularity assumptions for the admissible controls, which, while looking a bit nonstandard, are however quite natural in the corresponding analytical framework. In fact, they are indispensable prerequisites to guarantee the well-posedness of the associated state system. In this contribution, we employ recently proved existence, uniqueness and regularity results for the solution to the associated state system in order to establish the existence of optimal controls and appropriate first-order necessary optimality conditions for the optimal control problem.

This is a joint work with Juergen Sprekels.