Optimal Control Problem for a Nonlinear, Nonlocal Evolution System Describing an Interacting Ternary Mixture

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Abstract

This talk addresses an optimal control formulation for a continuum model describing morphology formation in interacting ternary mixtures, with one evaporating component. The state system consists of a coupled nonlinear, degenerate, and nonlocal parabolic evolution system originally derived in [1], where a phase-field indicator and a solvent concentration are linked through nonlinear, degenerating drift terms involving convolution operators. The evaporation is a new modeling feature of main interest here. This choice of problem is motivated by the need creating in silico optimal morphology designs for organic solar cells. The control problem is formulated with an L^2- type cost functional and is subject to PDE constraints given by a specific phase-field-concentration system introduced in [2, 3]. The control variable represents an external mechanism affecting the concentration of the solvent through suitable distributed sources, with the aim of steering the system towards desired configurations. We first discuss the well-posedness of the state system and establish the existence of optimal controls by using standard compactness and lower semi-continuity arguments. Furthermore, we analyze the control to state mapping and derive first order necessary optimality conditions via the corresponding adjoint system. The obtained results provide a theoretical framework for the systematic design of morphologies.

This is a joint work together with Nicklas Jävergård and Adrian Muntean (Karlstad University, Sweden).

References

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