

# Title: Optimal Control Problems for Phase-Field Systems

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Venue: PSB3103 and Google Meet

# Abstract

In this seminar, we will discuss few phase-field systems and control problems related to them. In particular we consider three systems:

1. Cahn-Hilliard-Brinkman system,
2. Local Cahn-Hilliard-Navier-Stokes system,
3. Nonlocal Cahn-Hilliard-Navier-Stokes system.

In the problem (1), we consider the controlled nonlocal Cahn-Hilliard-Brinkman system, where control is acting as an external force. We define optimal control problem as minimisation of certain cost functional with respect to the system. We prove the existence of an optimal control and characterise an optimal control in terms of the adjoint system using the variational techniques.

In problem (2), we consider the nonlocal stationary Cahn-Hilliard-Navier-Stokes system and prove the existence of a weak solution using maximal monotone operator techniques (Browder's theorem). We further show that a weak solution is unique under certain condition on the data of the system, and derive some regularity results. Finally, we show that the a stationary solution is exponentially stable.

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Finally, in problem (3), we use viscosity solution theory to study control problem related to the controlled local Cahn-Hilliard-Navier-Stokes system. We define the value function as infimum of a cost functional over the admissible control set and show that it satisfies the Dynamic Programming Principle. We further show that the value function is a viscosity solution of the corresponding Hamilton-Jacobi-Bellman equation. We also show the uniqueness of viscosity solution via comparison principle.

We end the talk with conclusions and some future plans.