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Seminar

Diffuse interface models: Application to tumour growth and shape optimization

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Abstract

There are many interesting phenomena occurring in nature and in industrial applications that involve multiple phases of matter, for example in the melting of sea ice and in the recovery of oil using water injection. While it is natural to view the interfaces separating the different components as idealized surfaces, the resulting mathematical models are difficult to analyze and simulate. In contrast, the diffuse interface methodology models the interfaces as transition layers with a small thickness, and the resulting model equations yield structures that are better amenable to further analysis.

In this talk, we discuss two applications of the diffuse interface method. In the first part of the talk a class of Cahn-Hilliard systems used to capture the basic dynamics of tumour growth are introduced. Then, I will discuss results concerning the well-posedness of the models, and present numerical simulations that capture the invasive growth behaviour observed in experiments. In the second part of the talk a shape optimization problem in fluid flow concerning drag minimization is studied. This has important consequences in the design of aircrafts, ships and cars. Using the diffuse interface method, we obtain a problem formulation which can be analyzed rigorously. In particular, optimal shapes are guaranteed to exist and I will present several numerical simulations for shape and topology optimization in fluid flows.

Date: 17 March 2017 (Friday)

Time: 10:30am – 11:30am

Venue: L1 Institute of Chinese Studies, The Chinese University of Hong Kong

All are Welcome