COMPMECH
Computational Mechanics & Advanced Materials

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SEMINARIO

Mathematical analysis of multi-component phase-field models

Phase separation in a binary liquid is a phenomenon which can be described as a competition between an entropy mixing effect and a demixing effect due to the internal energy. Typical mathematical models are given by the so-called Cahn-Hilliard (CH) equation or by the Conserved Allen-Cahn (CAC) equation with singular potential. The CH equation can be considered as to be local or nonlocal, according to the type of interactions (short range or long range) we take into account. These equations govern the evolution of the relative concentration of one component (phase field) and conserve the total mass. Nevertheless, in many applications one needs to deal with multiple interacting species. This justifies the interest in the analysis of multi-component phase-field models.

I will first briefly present the phase separation phenomenon through some of its recent applications in cell biology. Then I will introduce some of the aforementioned equations for a two-component mixture, like CH and CAC equations on bounded domains, trying to give an insight of some new results about the mathematical analysis of these equations. In particular I will focus on the results about the validity of the instantaneous strict separation property from pure phases.

Secondly, I will present how to extend the analysis to a multi-component mixture, leaning on some very recent results concerning well-posedness and long-time behavior of multi-component local CH and CAC equations.

In conclusion, if time permits, I will mention some possible future issues to be addressed, for instance, the nonlocal multi-component CH equation, the coupling with hydrodynamics through, e.g., the Navier-Stokes equations, and multi-component models for tumor growth.

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9 marzo 2023, ore 10:00 (precise)

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