Università degli Studi di Pavia

Dipartimento di Meccanica Strutturale

in collaboration with

Centro di Simulazione Numerica Avanzata – CeSNA
Istituto Universitario di Studi Superiori

SEMINAR

Phase-field models and Isogeometric Analysis

We describe the use of phase field methods to represent several problems in Fluid Mechanics and Biomechanics. Phase-field models typically involve higher-order differential operators and these are difficult to deal with by standard finite element approaches that utilize C0 trial and weighting functions. Our approach is based on Isogeometric Analysis, permitting simple and efficient discretizations through the use of smooth splines.

We present results for the classical Cahn-Hilliard equation, a two-phase model applicable to the segregation of phases in binary alloys, and many other physical phenomena. We are able to compute mesh independent, equilibrium solutions in two and three dimensions through the use of an adaptive time-stepping strategy and an innovative renormalization of the Cahn-Hilliard parameter that governs the thickness of diffuse interface layers. We present the first provably unconditionally stable, second-order, time-accurate integration algorithm for the Cahn-Hilliard equation, which exhibits robust and accurate solutions over a much greater range of time-step sizes than the often-employed Eyre method.

We have also applied our methodology to the Navier-Stokes-Korteweg equations, which describe coupled water and water vapor phenomena. We present solutions involving condensing vapor bubbles in two and three dimensions.

We will also present our current efforts to apply these technologies to the mathematical modeling and numerical simulation of cancer growth.

Dr. Hector Gomez
Associate Professor of Applied Mathematics
University of A Coruna, Spain

Tuesday, February 1, Aula MS1
Seminar tentative schedule: 10.00 – 11.30
Dipartimento di Meccanica Strutturale
Via Ferrata,1 – Pavia

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