Universidad Carlos III de Madrid

Seminario del Instituto Gregorio Millán

Coupled Mathematical Models for Multi-Phase Materials: Nonlinear Dynamics and Numerical Approximations

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Abstract

Coupled nonlinear mathematical models are essential in describing most natural phenomena, processes, and man-made systems. From large scale mathematical models of climate to modelling of quantum mechanical effects coupling and nonlinearity go often hand and hand. Coupled dynamic systems of partial differential equations (PDEs) provide a foundation for the description of many such systems, processes, and phenomena. In majority of cases, however, their solutions are not amenable to analytical treatments and the development, analysis, and applications of effective numerical approximations for such models become a core element in their studies.

In this talk we will focus on mathematical models that are based on the Landau framework of phase transformations based on non-monotone free energy functions. Phase transformations are universal phenomena, and one specific example that we will consider in this talk is motivated by mesoscopic mathematical models for the description of multi-phase solid materials. Such models provide an intermediate length scale description between the atomistic level and the level that is usually used for bulk materials. In particular, we will discuss several classes of problems where non-equilibrium phenomena such as phase transformations are important, focusing on the dynamics of materials with shape memory. The talk will provide further insight into their application areas, the development of computationally efficient reduction procedures for their 3D modelling, and the construction of fully conservative schemes for solving the associated problems.

Día y hora: Miércoles, 20 de marzo de 2013 a las 12:30 horas
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