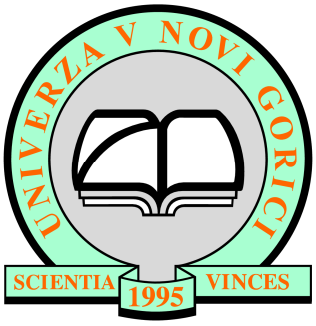

Graduate Physics Seminar
Monday, 09.05.2011 at 16:00
University of Nova Gorica, Ajdovščina site
Auditorium

MODELLING OF SOLIDIFICATION WITH SOLID PHASE MOVEMENT

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Abstract

Solidification represents a phase change where a multicomponent liquid turns into a solid when its temperature is lowered below its freezing point. The solidification morphology can be columnar or equiaxed, dendritic, cellular or planar. In case of equiaxed solidification the solid phase can move in the liquid, impinge with the solidification front and settle on the bottom of the system or flow on the top. The stationary solid phase can be modelled by porous media assumption and the movement of the liquid phase by the enhanced viscosity.

Modeling and simulation of solidification systems helps us understand not only various processes in nature, such as freezing of water or solidification of vulcano lava, but also creates better design of industrial systems, like continuous casting of steel or direct chill casting of aluminium.

The seminar presents the general strategy of dealing with such systems (which include stationary and floating solid phase) in the framework of continuum mechanics assumptions. Approaches based on the mixture continuum and volume averaging assumptions are presented, as well as one-phase and two-phase formulations. The mass, energy, momentum and species equations are taken into account on the macroscopic scale, together with the microscopic modelling, based on the cellular automata concept. The main goal of the seminar is an overview of the literature, description of a variety of physical modelling methods of such complex systems and development of the multiscale and multiphysics equations that will be used in a numerical model which finally lead to solidified grain structure.