11th. World Congress on Computational Mechanics (WCCM2014)
5th. European Conference on Computational Mechanics (ECCM V)
6th. European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

MULTISCALE METHODS AND APPLICATIONS IN COMPUTATIONAL MECHANICS

WEIQING REN*, YANG XIANG†

* National University of Singapore and IHPC
Department of Mathematics, NUS
10 Lower Kent Ridge Road, Singapore, 119076
matrw@nus.edu.sg, http://www.math.nus.edu.sg/~matrw

† The Hong Kong University of Science and Technology
Department of Mathematics
Clear Water Bay, Kowloon, Hong Kong
maxiang@ust.hk, http://www.math.ust.hk/~maxiang

Key words: Multiscale Methods, Crystal defects, Complex Fluids, Complex Energy Landscape, Rare Events.

ABSTRACT

Many problems in engineering and applied sciences involve multiple spatial and/or time scales. Examples include dislocations and cracks in solids, complex fluids, rare events, etc. In these problems, it is often interesting to understand the behaviour of the system at the macroscopic (relative to the small scales) spatial and/or temporal scales. However very often it is very challenging to obtain accurate macro-scale models by incorporating information of both macroscopic and microscopic scales. The more accurate micro-scale models do exist, but the difficulty is that they are prohibitively expensive for simulations of realistic systems.

In recent years, multiscale and/or multi-physics models and numerical methods have been proposed to overcome this difficulty. Well-known examples include the quasi-continuum methods for solids, the heterogeneous multiscale methods, coupled atomistic-continuum methods for complex fluids and micro-fluidics, numerical methods (e.g. the string method) for exploring complex energy landscapes and modelling rare events, etc. In this mini-symposium, we will discuss the mathematical aspects of the multiscale models and related numerical methods, as well as their applications in materials science, fluid dynamics and other applied sciences.

Topics of the mini-symposium include:

- Defects in solids (dislocations, cracks, grain boundaries, etc)
- Complex fluids, multi-phase fluids, the moving contact line problem
- Numerical methods for understanding complex energy landscapes and the simulation of rare (barrier-crossing) events
- Multiscale models and numerical methods