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 COMPUTATIONAL MECHANICS OF MICRO- AND NANO- COMPOSITE MATERIALS

ŁUKASZ FIGIEL [*], MARCIN KAMIŃSKI [†]

[*] Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences
Sienkiewicza 112, 90-363, Lodz, Poland
lfigiel@cbmm.lodz.pl

[†] Chair of Structural Reliability, Department of Structural Mechanics
Technical University of Lodz, Al. Politechniki 6, Lodz, Poland
Marcin.Kaminski@p.lodz.pl

Key words: Computational Mechanics, Composite Materials, Multiscale modeling and simulations, Probabilistic Methods.

ABSTRACT

Micro- and nano-composite materials are currently being developed for a wide range of energy-efficient light-weight and multifunctional applications, ranging from structural components of aircraft to flexible displays in nano-electronics. Development of efficient computational approaches and tools for the prediction of manufacturing, end-use properties, structural reliability and durability of composite materials can facilitate their optimum design and use in novel applications.

One of the primary challenges in a development of predictive computational tools for composite materials is their hierarchical structure, which requires the brand new multiscale approaches. For the most efficient prediction, these computational approaches must simultaneously account for coupling of different physical fields, such as mechanical, thermal, and electrical across different length and time scales as well as stochastic material properties and uncertainty in the boundary/initial conditions. As a result, this type of research is often difficult to perform and still in its infancy. There are numerous researchers around the world that are working on many aspects of multiscale approaches for composite materials. Each approach is very unique, yet no one has established a reliable procedure to couple all of these physical fields in a multiscale probabilistic computational framework.

This mini-symposium addresses issues related to multiscale computational approaches for the prediction of manufacturing, end-use properties and structural reliability of composite materials. Therefore, we invite the papers concerning development and application of multi-scale computational approaches for micro- and nano-composites. Special attention is paid to both deterministic and stochastic atomistic-continuum approaches and FE^2-like continuum approaches. As a result, the invited researchers will all gain an improved understanding of the world-wide efforts in this field, which should facilitate the development of the multiscale computational methods for composite materials.