Guest editorial

Computational modelling of multi-uncertainty and multi-scale problems

The development of multi-uncertainty and multi-scale models has received significant attention over the past decades. New mathematical formulations and numerical solution strategies allied to the increase in computational power/cost ratio have fostered a dramatic growth in this rapidly expanding field. Research activity in this area has been devoted to the development and combination of different analytical tools such as mathematical homogenization and asymptotic analysis, with computational methods such as parallel computing, stochastic analysis and coupled problems, among others. Such developments have been applied to fields as diverse as metal and polymer processing, composite materials, oil and gas development, fuel cell technology and biomedical tissue engineering, etc.

The progress achieved in these research topics has played a central role in understanding the interaction among multi-physics and multi-uncertainty phenomena taking place at multiple scales in space and time. Nevertheless, new challenges remain, emerging both theoretically and practically, and these outstanding challenges continue to drive the most forefront research in computational mechanics and computational engineering.

This special issue contains 25 selected papers, presented at the EUROMECH colloquium on multi-uncertainty and multi-scale methods and related applications and the ECCOMAS thematic conference on Computational Modelling of Multi-Uncertainty and Multi-Scale Problems, held, respectively, from 14 to 16 September 2016, and from 12 to 14 September 2017, in Porto, Portugal. We hope that the special issue provides an overview of some of the latest research works conducted by the multi-uncertainty and multi-scale community. The following research topics are covered: computational homogenization; multi-scale modelling; stochastic modelling, probabilistic engineering, reliability and risk assessment; modelling of multi-physics processes/systems; computational coupling strategies; material design; topology optimization; multi-objective optimization; and high-performance computing.

Francisco M. Andrade Pires
Department of Mechanical Engineering, Faculty of Engineering, University of Porto, Porto, Portugal, and
Chenfeng Li
Zienkiewicz Centre for Computational Engineering and Energy Safety Research Institute, College of Engineering, Swansea University, Swansea, UK

Engineering Computations
Vol. 35 No. 2, 2018
p. 498

0264-4401
DOI 10.1108/EC-02-2018-0104