

Foreword

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The increasing power of computers and the advent of numerical methods and simulation-based sciences have brought enormous changes in many scientific fields. Well-established paradigms in engineering sciences, based on analytical or experimental methods, are increasingly being replaced by or coupled to computational methodologies that, though requiring intensive computations, supply detailed information and rapid answers to engineering problems, much beyond the dreams of the past decades.

Fracture mechanics is not alien to this process, and the emerging field of *Computational Material Fracture* is attracting increasing attention of researchers, both from traditional areas of fracture mechanics and from the computational mechanics community, who

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envisage in that discipline an appealing and challenging scientific field. New industrial applications of fracture mechanics, which appear in this context, often require the development of innovative computational methods that can efficiently capture material failure. Such methods can then be applied at the structural scales in civil, mechanical, aerospace and naval industries, among others, giving responses to problems which were considered as out of reach only a few years ago.

This special issue of *International Journal of Fracture* collects an extended version of selected contributions to the *Second International Conference on Computational Modeling of Fracture and Failure of Materials and Structures (CFRAC 2011)* held in Barcelona, Spain, on 6–8 June 2011. This series of thematic conferences was initiated by CFRAC 2007 (Nantes, France) and is going to be continued in the immediate future by CFRAC 2013 (Prague, Czech Republic). In accordance with the motivational statement of CFRAC 2011, “... *the aim of the conference is to gather academic researchers and industrial partners involved in development and application of numerical procedures for fracture and failure simulation of materials and structures...*”, the papers of this special issue of IJF fit into the above considerations and constitute a good representation of the topics of the mini-symposia organized in the conference framework. They have been selected based on a proposal of the mini-symposia organizers, followed by the standard peer review procedures of IJF. The topics of the

papers encompass a variety of subjects in computational modeling of fracture, and they have been ordered in this issue according to the following research areas:

- New developments in finite elements for capturing strong discontinuities
 - Computational strategies in specific approaches to fracture (cohesive zone, continuum damage, gradient damage models, phase field models)
 - Multiscale analysis of fracture and computational homogenization procedures
 - Crack propagation and branching in dynamic fracture
- Specific actions in fracture problems (thermal actions, chemical actions and hydraulic fracture)
 - Structural failure due to material fracture (masonry, concrete members, shells)

The editors believe that this special issue is a representative portrayal of the current state of the art of research in modeling and numerical simulation of material failure. They expect this to be a topic of prime interest for readers of the *International Journal of Fracture* and they thank very specially the authors of the compiled papers for their contributions.