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PREFACE

Multibody system dynamics, a branch of computational mechanics dealing with modeling principles and computational methods for dynamic analysis, simulation, and control of mechanical systems is a rapidly developing field that allows for virtual prototyping and exploitation environment simulation of a large spectrum of industrial products: from the 'standard' industrial production that includes all kinds of vehicles, rotational machines and mechatronical devices to recent products at the nano-dimensional level of the biomolecular structures and smart materials. Such versatility of applications is rooted in the characteristics of the basic modeling principles the discipline is starting from, which, being based on kinematical and dynamical coupling of the rigid and flexible bodies of different characteristics and mechanical properties (or particles – at the molecular level, for example), serve as a successful modeling framework for such a broad class of objects in engineering and applied physics.

However, to cope with more and more challenging applications in the context of more demanding materials, exploitation conditions and design requirements, the discipline had to develop and incorporate different modeling methodologies which, although conventionally divided or loosely coupled in the past (and classically belonging to other branches of mechanics, applied mathematics and computer science), find their successful co-existence within the framework of contemporary multibody dynamics computational models. Indeed, since its establishment in the 70-ies of the last century as a discipline that primarily focused on the rigid body mechanisms and mechanical systems, multibody system dynamics grew today as a field that offers solution for various modeling, optimization, and control tasks of quite complex highly developed industrial products that often include 'multiphysics' approaches, computational coupling techniques, geometric integrators or modeling at the different levels of the time-space mechanical and integration scales.

All these aspects, and many more relevant topics of the contemporary multibody dynamics, were discussed during the ECCOMAS Multibody Dynamics 2013 conference that was held at the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Croatia in July 2013. The objective of the Conference was to present the state of the art in the theory and applications of multibody system dynamics, to provide a forum for discussions on relevant research issues and to serve as a meeting point for international researchers, scientists and experts from academia, research laboratories, and industry.

This special issue of AME consists of selected, revised and extended versions of papers presented at the conference, reporting on the state-of-the-art in the advances of computational multibody dynamics, from the recent theoretical developments (such as geometric modeling and integration procedures) to diverse practical engineering applications. We would like to thank all the authors for the time and effort they devoted to the completion of their contributions. We would also like to thank all reviewers for their expert work during reviewing the articles – their assistance has been very valuable in shaping the final forms of the published papers.

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