Editorial

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Biographical notes: Carmine Maria Pappalardo received his BS and MS with Summa Cum Laude honours in Mechanical Engineering from the University of Salerno, Fisciano, Italy, in 2006 and 2008, respectively. He received his PhD with Summa Cum Laude honours in Multibody System Dynamics from the University of Salerno, Fisciano, Italy, in 2012. He was a Post-Doctorate at the Department of Industrial Engineering of the University of Salerno, Fisciano, Italy, from 2012 to 2014. He was a Visiting Researcher at the Department of Mechanical and Industrial Engineering of the University of Illinois at Chicago, Chicago, Illinois, USA, from 2014 to 2016. He was a Post-Doctorate at the Department of Industrial Engineering of the University of Salerno, Fisciano, Italy, from 2016 to 2019. Since 2019, he is a Tenure-Track Assistant Professor at the Department of Industrial Engineering of the University of Salerno, Fisciano, Italy. His current research interests are multibody dynamics, nonlinear control, and system identification. He is the author of more than 50 scientific publications on these topics.

Qiang Tian is a Full Professor of the Beijing Institute of Technology, Beijing, China. His interests lie in modelling methods and numerical algorithms for multibody system dynamics, dynamics of large space flexible deployable structures, and dynamics and control of soft robotics. He is an Associate Editor of *Mechanism and Machine Theory Journal*, an editorial board member of

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In this special issue, research on vehicle system dynamics analysed within the multibody framework are highlighted from the viewpoint of formulation, modelling, computation and experimentation. In particular, the goal of this special issue was to promote advancements in the area of vehicle dynamics using multibody system algorithms for virtual prototyping. Its focus is on current advances in analytical and computational algorithms that lead to sound formulation approaches suitable for modelling vehicle systems.

Multibody systems are mechanical systems composed of rigid and flexible components. The motion of multibody mechanical systems is constrained by kinematic joints and is due to the action of nonlinear forces and nonlinear force fields applied to the system bodies which generate complex dynamic behaviours. In general, multibody systems are mathematically modelled using nonlinear sets of differential-algebraic equations (DAEs). Therefore, the multibody approach to the analysis of vehicle performance represents a fundamental tool suitable for performing virtual prototyping of modern engineering systems.

One of the principal aspects of this special issue is the focus on the fundamental theories, and the corresponding numerical methods used for computer implementation, that are employed in computational mechanics and in vehicle dynamics. These analytical approaches and computational techniques can be effectively used to develop computer programs for analysing the static and dynamic response of multibody mechanical systems having different degrees of complexity, as in the case of the mechanical models employed for describing vehicle systems. The resulting equations of motion are systematically formulated considering the fundamental principles of classical mechanics and then solved numerically.

The purpose of the present special issue is to provide an overview of the current research in the field of vehicle system dynamics based on multibody algorithms. From a general perspective, the subjects covered in this special issue span a wide range of engineering problems. These include, but are not limited to, rigid-flexible multibody systems, finite element formulations, large rotation problems, large deformation problems, methods for formulating and solving the differential-algebraic equations of motion (DAEs), developments in the kinematic and geometric description of the motion, finite element technologies, nonlinear control techniques for vehicle dynamics, modelling and dynamic analysis approaches, experimental model validation techniques. More specifically, the nine papers presented in this special issue deal with the wheel–rail wear simulation and rail cant optimisation based on railway vehicle dynamics (by Li et al.),

the study the dynamic behaviour of a seven-degrees-of-freedom full car model with a semi-active suspension system (by Krishna et al.), the development of hierarchical control strategies of electromagnetic active mounting systems (by Chen et al.), the performance evaluation of different centrifugal pendulum morphologies through multibody dynamics simulation (by Cirelli et al.), the out-of-plane tyre model development for vehicle dynamic simulation on various rigid road surfaces (by Li et al.), the simulation and experiments on a three-wheeled vehicle running on different tracks (by Ravikanth and Sujatha), a dynamic model of a Cardan joint to evaluate the effect of elasticity and manufacturing errors (by Cirelli et al.), the model-based simulation of the dynamic behaviour of electric powertrains and their limitation induced by battery current saturation (by Mangoni and Soldati), the dynamic behaviour of the transmission belt drive of a water pump for an internal combustion engine (by Sequenzia et al.). Thus, all the papers collected in this special issue clearly reflect some of the most relevant and recent developments in the general areas of multibody systems and vehicle dynamics.