Preface

The materials presented in this monograph are the result of the 25th anniversary Polish-Slovak Scientific Conference: Machine Modelling and Simulation - MMS 2020. The idea of organizing cyclic, annual Polish-Slovak conferences was born as a result of earlier long-term cooperation between Poznan University of Technology and the Higher School of Transport and Communication (now University) in Žilina in 1996. The organizer of this conference was the Faculty of Mechatronics of Kazimierz Wielki University in Bydgoszcz and the co-organizer was the Committee on Production Engineering of the Polish Academy of Sciences.

Issues related to machine modeling and simulation are the use of models (e.g., physical, mathematical, or logical representation) as a basis for simulation to develop data used to make technical decisions, in the field of mechanical engineering. This technology belongs to the tools of engineers of all application domains and has been incorporated into the body of knowledge of engineering management. Modeling and simulation aid in the areas of cost reduction, improving product and system quality, and documenting conclusions gained. Additionally, models can be updated and improved using results from real-world experiments. Artificial intelligence (AI) and computational intelligence (CI) are increasingly important in building these models. AI and CI methods deal with methods to solve problems that cannot be efficiently solved algorithmically. These methods play an important role in the development of inference and intelligent systems. The application of modern methods (AI and CI) in the field of mechanical engineering is particularly interesting due to its research and practical character and very strongly relates to Industry 4.0. The topics of individual sections are in line with current research trends in the discipline of mechanical engineering. It combines the experience of researchers and conference participants with the latest trends in the discipline, in particular with research in the field of Industry 4.0.

The collective concept of integrating intelligent machines, systems and making changes in production processes to increase production efficiency and the possibility of flexible variations of products range are just some of the areas presented by scientists from Slovakia, Czech Republic and Poland. Industry 4.0 concerns not only technology, but also new ways of working and the role of human beings in industry, integrating people and digitally controlled machines with the Internet and information technologies. The materials manufactured or used for production can always be identified, they also have the ability to communicate independently with each other. Information flows vertically: from individual components to the company's IT department and from the IT department to the components. The other direction of information flow is realized horizontally: between the machines involved in the production process and the company's production system. Therefore, these issues correspond closely to the content of this publication.

A total of 97 papers were presented at the conference, of which 74 articles were selected for publication in the Matec monograph, after review.

Scientific problems of the conference were included in the following eight thematic sections:

- Methods and Systems in Machine Design,
- Modelling and Simulation, Structural Optimization,
- Machine Dynamics and Multibody Systems Simulation,
- Advanced Industrial, Automotive and Green Energy Applications,
- Experimental Mechanics, Identification and Validation,
- Modelling of Structural Materials, Composities and Nanomaterials,
- Physical and Chemical Properties of Materials,
- Theoretical and Applied Mathematics in Engineering.

The conference is organized to bring together academics, researchers and practicing engineers to share their experiences in the field of machine modeling and simulation.MMS 2020 provided an opportunity for networking among participating institutes/organizations/industry to systematically address challenges in common areas of interest.The conference was intended as a forum where researchers, university professors, PhD students, undergraduates and mechanical engineers come together to present new scientific, technological and engineering developments, new ideas and advances in science, technology and engineering.

We thank the scientific support from the review committee and editors of this issue. We are grateful to the conference organizing committee members, scientific committee members, reviewers, session chairs, and volunteers, without whose generous contributions this conference could not have taken place.

I am especially grateful to the authors for their contributions and to all the participating experts for their valuable advice.

Finally, I would like to thank MATEC Web of Conferences for its professional assistance, and in particular Solange Guéhot, Elodie Guillaud, and Isabelle Houlbert, who supported this publication.

Marek Macko