Editorial

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Biographical notes: Sergei S. Sazhin received his PhD from St Petersburg State University (Russia) in 1977. Currently, he is working as a Professor of Thermal Physics at the University of Brighton (UK). He is the author of more than 500 publications, including three monographs, nine book chapters and 243 papers in international refereed journals. His current ISI Web of Science citation index is 35. He has been a Fellow of the Institute of Physics (UK) since 1994, received a Leadership in Research Excellence Award from the University of Brighton in 2017, and has been a member of the Scientific Council of the International Centre for Heat and Mass Transfer (ICHMT) since 2018. His previous research focused on of asymptotic models for wave propagation in plasma, and modelling of the processes in thermodynamically non-equilibrium systems. His current research interests focus on numerical and asymptotic modelling of fluid dynamics, heat/mass transfer, and combustion processes in sprays.

Elena Shchepakina received her PhD from Samara State Pedagogical University (Samara, Russia) in 1995 and Doctor of Science (DSci) from N.E. Zhukovskii Airforce Engineering Academy (Moscow, Russia) in 2004. Currently, she is working as a Professor of the Department of Differential Equations and Control Theory at Samara National Research University (Russia). She has written more than 150 publications, including three monographs and about 100 papers in international refereed journals. She has been a member of the Organising and Steering Committees of several international conferences, including the International Workshop on Relaxation Oscillations & Hysteresis, the International Workshop on Hysteresis and Multi-Scale Asymptotics, and the International Workshop on Multi-rate Processes and Hysteresis. Her current research interests focus on differential equations and dynamic systems, geometrical methods and integral manifolds theory, the mathematics of combustion, biochemistry and chemical kinetics, and the mathematical modelling of critical phenomena in biological and reacting systems.

Vladimir Sobolev received his PhD from the Institute of Mathematics of the Ukrainian Academy of Science (Kiev, USSR) in 1980 and Doctor of Science (DSci) from the Institute of Systems Studies of the Russian Academy of Science (Moscow, Russia) in 1991. He is a Professor and Chair of the Department of Differential Equations and Control Theory at Samara National Research University (Russia). He is the author of more than 200 publications, including eight monographs and more than 100 papers in international refereed journals. He is a member of the American Mathematical Society since 1984, and the Chair of scientific committees of many international conferences, including the International Workshop on Relaxation Oscillations & Hysteresis, the International Workshop on Hysteresis and Multi-Scale Asymptotics, and the International Workshop on Multi-rate Processes and Hysteresis, Nonlinear Modeling and Control. His current research interests focus on systems theory and control, differential equations and dynamic systems, and the mathematical modelling of biological and chemical systems and combustion processes.

The importance of mathematical modelling of various processes in engineering, environmental, biological and medical applications is widely recognised and numerous papers and monographs on this topic have been published, including those prepared by the editors of this volume. Most published studies in this direction have focused on specific engineering, environmental, biological or medical problems for which specific mathematical modelling tools have been developed. In contrast to this common approach we have deliberately collected contributions that focus on the modelling in all these fields of research. This has allowed us to refocus on the mathematical tools themselves and to develop a clearer view of the common features of the application of these tools to modelling in all these fields.

The papers selected for this volume were presented at the Fifth International Conference on Information Technology and Nanotechnology (ITNT 2019) held in Samara (Russia) in May 2019. All papers were carefully reviewed to ensure the highest possible standard for this volume.

The first paper 'Phase equilibrium modelling for multi-component mixtures using highly accurate Helmholtz energy equation of state', by Taiming Luo and Alexei Yu. Chirkov, looked at phase equilibrium modelling for multi-component mixtures using the highly accurate Helmholtz energy equation of state. This paper studied the phase stability of a mixture under given conditions. Equilibrium phase compositions were modelled for the unstable original phase of the mixture. Using the Helmholtz free energy equation of state, thermodynamic properties in single phase and two-phase equilibrium were calculated for methane-ethane mixtures.

The second paper, entitled 'Oscillations and hysteresis: from simple harmonic oscillator and unusual unbounded increasing amplitude phenomena to the van der Pol oscillator and chaos control', by Mikhail E. Semenov et al., investigates various oscillating systems under hysteretic action. Unusual unbounded increasing amplitude phenomena, where the rate of amplitude growth is proportional to the square root of time), are identified and discussed for a simple harmonic oscillator under hysteretic conditions.

This is followed by a paper by Vladimir S. Nozhkin et al., entitled 'A model of advective changes in air humidity: a stochastic approach'. In this paper, a novel approach to the solution of a moisture transfer problem is presented. The distribution of the projections of the instantaneous velocity vector is approximated by the Vaga-Ising law, and the parameters of this distribution are identified based on a bionic model of adaptive search behaviour.

The paper entitled 'Controlled attitude motion of the space tether system at the retraction tether stage', by Ruslan S. Pikalov and Vladimir S. Aslanov, looks at the dynamics of a rendezvous between a tug and large space debris connected by a viscoelastic tether. The dynamics of manoeuvring the rendezvous and finding ways to control the attitude motion of a space tether system are investigated.

In the paper 'Impact analysis and orbit reboost of payload tossing using spinning electrodynamic tether system', by Hongshi Lu et al., it is shown that spinning electrodynamic tether systems are good platforms for payload transportation, but require orbit reboosts after one or several tossing manoeuvres. An impact analysis is proposed to predict the change of system orbits after payload tossing.

Vladimir Alekseyevich Fursov et al.'s paper, 'Thematic classification with support subspaces in hyperspectral images', analyses a classification algorithm for plant crops in hyperspectral images. This algorithm uses the conjugation index with a subspace formed by samples of a given class. The purpose of this investigation is to show that this algorithm, together with data pre-processing (weighting of the feature vector's components and forming of the subclasses), provides a higher classification quality compared to the well-known reference vector method SVM.

The paper by Victor Zhidchenko et al., entitled 'Application of digital twin and IoT concepts for solving the tasks of hydraulically actuated heavy equipment lifecycle management', considers using Digital Twin and IoT concepts to solve problems related to the operation and maintenance of hydraulically actuated heavy equipment. A technique for the remote surveillance of heavy equipment is presented.

In the paper 'Numerical analysis of parameter identifiability for a mathematical model of a chemical reaction', by Liana Safiullina and Irek Gubaydullin, a numerical approach is used to identify the parameters of a mathematical model for a chemical reaction, and procedures are developed to facilitate the process. The analysis primarily considers low-temperature propane pyrolysis with the detailed scheme containing 157 reactions.

Maxim Polyakov's paper 'Computational modelling to determine the physical characteristics of biological tissues for medical diagnosis' focuses on timely diagnosis of breast cancer. The method of microwave radiothermometry, based on measuring the internal temperature of biological tissues in the microwave frequency range, is used. The need to build personalised models, considering the individual nature of the internal structure of the mammary gland in each patient, is emphasised. The results are shown to be in good agreement with previously known exact solutions, which allows the author to recommend this method for solving this class of problems.

Lede Niu et al.'s paper, 'Research on dynamic simulation and prediction of urban expansion based on SLEUTH model', proposes a method for dynamic simulation of urban expansion based on a slope, land use, urban area, traffic, exclusion, Hillshead (SLEUTH) model. This method uses processed urban spatial data to establish a SLEUTH model of dynamic urban expansion, and it analyses the driving factors of urban expansion that are used as the influencing factors of urban expansion simulation.

The final paper of the volume, 'Numerical simulation of landslide motion based on thermo-plastic mechanics', by Zhongfu Wang et al., concerns frictional heating,

a mechanism long considered responsible for some remarkable characteristics of natural slides, including their surprisingly long travel distances and high velocities. A method considering thermo-plastic mechanics is combined with a depth-averaged model for simulating the long run-out motion of landslides under deformation conditions. The effectiveness of the model is demonstrated by comparing the numerical results with the results of field investigation of landslides in Sanxicun, China.

We are grateful to all contributors and reviewers for their valuable input to this volume. It was a pleasure to work with Professor Xiaogang Yang, Editor-in-Chief of the *International Journal of Engineering Systems Modelling and Simulation*, and Ms. Alexandra Starkie and her Inderscience publishing team.