Overview of the II International Workshop "Hybrid methods of modeling and optimization in complex systems" (HMMOCS-II 2023)

Predrag Stanimirović[1,2], *Alena* Stupina[1*], and *Igor* Kovalev[3]

[1]Laboratory "Hybrid Methods of Modelling and Optimization in Complex Systems", Siberian Federal University, Krasnoyarsk, Russian Federation
[2]University of Niš, Faculty of Sciences and Mathematics, Niš, Serbia
[3]Siberian Federal University, Krasnoyarsk, Russian Federation

Abstract. The Overview is devoted to the main results of the II International Workshop "Hybrid methods of modeling and optimization in complex systems" (HMMOCS-II 2023) which was held in Krasnoyarsk, Russia on 28-30 November 2023. It describes the main directions and gives the details about the participants and the proceedings.

The volume contains the proceedings of the II International Workshop "Hybrid methods of modeling and optimization in complex systems" – HMMOCS-II 2023 held on 28-30 November 2023 in Krasnoyarsk, Russian Federation.

The purpose of the workshop was to share the original results in mathematical modeling for software- and hardware applications in various fields.

The event offered a platform for bringing together postdocs, innovative academics and scientists to exchange their ideas and contribute new innovative approaches to modeling and optimization in complex systems.

The workshop provided the premier interdisciplinary and multidisciplinary forum for researchers, practitioners and educators to present and discuss the most recent innovations, trends, concerns, practical challenges and the solutions in the fields of mathematical modeling, mathematical logic, applications of the data analysis methods, machine learning models, application of fuzzy logic, developing algorithms for economics and industrial applications, virtual robotics, cognitive modeling, nonlinear optimization, data clustering, artificial neural network architecture, adaptive computing technologies, automatic grouping of metadata etc.

Although the schedule of the workshop was very tight, there were very vivid discussions among the participants.

The program of the workshop consisted of keynote and plenary talks, presentations of the participants. The Plenary Talks and Keynote Speeches were held in Krasnoyarsk. The parallel sessions took place online.

The presentations of the key speakers presented current research and best practices in the field of hybrid methods of modeling and optimization in complex systems.

* Corresponding author: h677hm@gmail.com

The report of Prof. Predrag Stanimirović from University of Nis, NIs, Serbia was devoted to new ZNN dynamical systems based on nonlinear optimization methods.

The speech of Prof. Jajati Keshari Sahoo from Department of Mathematics, BITS Pilani K K Birla Goa Campus, Goa, India presented current research in the field of regularization theory in machine learning.

Professor Mario Guarracino from National Research University Higher School of Economics, Laboratory of Algorithms and Technologies for Networks Analysis, Nizhny Novgorod, Russia presented a report in the topic of graph embedding methods and applications.

The Workshop featured presentations in which researchers and experts shared their latest discoveries and research results in methods for detecting and counting nodes in images of crack networks; software system for contactless text input based on computer vision; topological optimization of the design of a permanent magnet synchronous motor using a genetic algorithm; system for analyzing data from camera traps based on a two-stage neural network approach for operational remote monitoring; CFD simulation of unstable fluid flows in the rotor of a high-speed precipitation centrifuge; supervised machine learning with regression for the IRT-T reactor cooling system; modeling reflection in artificial intelligence systems; everted U-Net for 3D scene reconstruction and segmentation; optimized zone-based vehicle speed estimation and classification, etc.

The participants of the Workshop presented universities from Serbia, Italy, India, China, Uzbekistan, Athens, Ecuador and such regions of the Russian Federation as Krasnoyarsk, Moscow, St. Petersburg, Tambov, Birobidzhan, Altai, Tomsk, Orenburg, Astrakhan, Togliatti, Kazan, Kaliningrad etc.

The thematic sections of the workshop were devoted to:

- Mathematical models and their applications
- Mathematical modelling techniques
- Optimization techniques, incl. multi-criterion optimization and decision making support
- Hybrid methods of mathematical modelling and optimization in complex systems
- Data mining and knowledge discovery
- Machine learning
- Pattern recognition
- Learning in evolutionary algorithms
- Genetic programming
- Artificial neural networks
- Computational intelligence and its applications
- Bio-inspired and swarm intelligence
- Text/Web/Data mining
- Human-Computer Interaction
- Natural language processing
- Applications in engineering, natural sciences, social sciences, computer science, etc.

All papers came through the basic review which included an initial technical criterion check (paper field, structure of submission, adherence to the submission instructions, English language usage and a check for the similarity rate). Any papers out of the scope or containing plagiarism, including self-plagiarism, were rejected. The organization committee used a double anonymous system for peer review; the reviewers' identities remained anonymous. The submitted papers were reviewed by at least two external reviewers. The third reviewer was involved in case the reviewers had had doubts about the content of the papers or the authors had not agreed with the review result. The review process took from 5 to 10 days as a rule. The reviews were conducted to the professional and scientific standards. The Antiplagiat software program was used for plagiarism detection. The decision to accept or

reject the paper was based on the suggestions of reviewers. Acceptance/rejecting notifications were sent to the corresponding author(s).

Workshop submission was carried out through the workshop management system developed by the Organizer. It is easy to use, and has features to make it suitable for simultaneous conference or workshop calls. More than 20,500 registration forms have been already processed by the system which showed it stability and flexibility. The management system is integrated with the workshop website of the Organizer which helps the Organizer to cope with the complexity of the submission, reviewing, refereeing and accepting processes. The current version supports management of the access of reviewers and editors to papers; automatic registration and paper submission; list of the current, forthcoming and held conferences and workshops with all necessary information; list of all conference and workshops materials with online presentations and/or video reports of participants, list of published proceedings with direct links to publications and journals; sending emails to programme committee members, reviewers and authors; preparation and publishing of conference and workshop programmes; all authors submitting the papers are assumed to accept the terms of Publication Licence and send to the Organizer signed Copyright Form and Conflict of Interest Declaimer; all requirements for papers, templates and sample papers are accessible for the authors.

A total of 32 reviewers were involved into the process of revision. The external reviewers were invited from the Russian and International Union of Scientific and Engineering Associations, Russian Academy of Sciences, Siberian Federal University (Russia), Reshetnev Siberian State University of Science and Technology (Russia), Voronezh State Technical University (Russia), Bukhara and Namangan Engineering Technological Universities (Uzbekistan), University of Niš (Serbia), University of Cadiz (Spain), National and Kapodistrian University of Athens (Greece). The Checklist for the reviewers included the following criteria: relevance to the scope of the conference topics, the scientific quality, assessing the errors, organisation of the paper, the title, the references, the level of the English language, the quality of the figures and tables, etc. The reviewers could give the following recommendation: to publish the paper as it is, to publish it after mandatory/optional minor/major revision, to reject the paper.

There were 150 applications received, 120 submissions were sent for review, more than 70 papers were accepted. The Volume presents scientific papers in 4 main sections:

- Hybrid Modeling and Optimization in Complex Systems: Advances and Applications
- Interdisciplinary Mathematical Modeling and Applications
- Data mining, machine learning and pattern recognition
- Adaptive Intelligence: Exploring Learning in Evolutionary Algorithms and Neural Networks.

Special thanks are given to all the reviewers, the members of the Programme Committee. We would also like to thank Prof. Maxim Rumyantsev, rector of the Siberian Federal University for collaboration and all those who contributed to every process to improve the quality of this issue and to provide reviewing process, efficient reports and discussions during the workshop.

This work was supported by the Ministry of Science and Higher Education of the Russian Federation (Grant No.075-15-2022-1121).

Editors

Predrag S. STANIMIROVIĆ,
Dr. Sc., Professor, 0000-0003-0655-3741, pecko@pmf.ni.ac.rs
Laboratory "Hybrid Methods of Modelling and Optimization in Complex Systems",
Siberian Federal University, Krasnoyarsk, Russian Federation
University of Niš, Faculty of Sciences and Mathematics, Niš, Serbia

Alena A. STUPINA,
Dr. Sc., Professor, 0000-0002-5564-9267, h677hm@gmail.com
Siberian Federal University, Krasnoyarsk, Russian Federation

Igor V. KOVALEV,
Dr. Sc., Professor, 0000-0003-2128-6661, kovalev.fsu@mail.ru
Siberian Federal University, Krasnoyarsk, Russian Federation

International Programme Committee

Co-Chairmen:

PREDRAG STANIMIROVIĆ
University of Nis, NIs, Serbia

LEV KAZAKOVTSEV
Reshetnev University, Russia

ALENA STUPINA
Siberian Federal University, Russia

Members:

HIJAZ AHMAD
Section of Mathematics, International Telematic University Uninettuno, Roma, Italy

ALEKSEI VAKHNIN
University of Eastern Finland, Finland

DIJANA MOSIC
University of Nis, Faculty of Sciences and Mathematics, Nis, Serbia

JAJATI KESHARI SAHOO
Department of Mathematics BITS Pilani-K.K Bilra Goa Campus NH-17B, Goa, India

OLEG KRAVETS
Ton Duc Thang University, Ho Chi Minh City, Vietnam

RATIKANTA BEHERA
Indian Institute of Science Bangalore, Bangalore, Karnataka, India

IGOR KOVALEV
Department of Informatics, Siberian Federal University, Russia

SPYRIDON MOURTAS
National and Kapodistrian University of Athens, Greece

ROMAN SERGIENKO
Riskmethods GmbH, Munich, Germany

STEFAN STANIMIROVIĆ
University of Niš, Serbia

INMACULADA MEDINA-BULO
Universidad de Cádiz, Spain

ROMAN KUZMICH
Siberian Federal University, Russia

IVAN ROZHNOV
Siberian Federal University, Russia

KOMIL ASTANAKULOV
NRU TIIAME, Tashkent, Uzbekistan

AKBAR ABRAROV
Bukhara Engineering Technological Institute, Uzbekistan

VADIM TYNCHENKO
Bauman University, Moscow, Russia