

DISTRIBUTED COMPUTING AND COMPLEX APPLICATIONS

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The Institute of Informatics of the Slovak Academy of Sciences, the publisher and founder of the CAI journal, celebrates its 60th anniversary. It is one of more than 50 scientific and research institutes of the Slovak Academy of Sciences. The Institute belongs to top research institutions in Slovakia and it occupies a stable place within the international research area.

This special section is dedicated to our anniversary. Some of the recent significant scientific results of the Institute are published in this section.

The Institute started its path as the Laboratory of Theoretical and Applied Mechanics, which successfully transformed into the Institute of Technical Cybernetics and later into the present form. Between the years 1956 and 1958 the first Slovak analogous computer was successfully developed here. The Institute has been a promoter of the application of research results to industrial products since its very beginning. For example, the control computer RPP16 which was developed between 1965 and 1968 has still been in use for some operations. Of course, the work of information scientists has changed considerably over the years.

Recently research and development activities of the Institute have focused mainly on the knowledge and semantic technologies, speech analysis and synthesis, mathematical modelling and computer simulation of complex nature phenomena. Significant results were achieved also in the field of design and testing of systems on chips, design, analysis and simulation of micro-robotic devices and other related areas. In line with the current trends we are strongly oriented on High Performance Computing and Big Data technology. The research results in these areas have been applied and further successfully developed as part of important national and international projects.

The Institute is currently known as one of the most successful Slovak organizations when it comes to acquiring national and international research grants. It

is a steady participant in the European Framework Programmes and from FP4 to current H2020 it has cooperated in almost 40 projects, in some of them as a coordinator. Besides that the Institute has been involved in projects financed by several international bodies, for example NATO, the European Defence Agency (EDA) and several others. The Institute and its employees are members of important professional organizations like IEEE.

Papers in this special section present research results in the areas of parallel and distributed computing, complex applications, artificial intelligence and speech synthesis that belong to the main research topics of the Institute.

The paper “Application Performance Optimization in Multicloud Environment” by Martin Bobák, Ladislav Hluchý and Viet Tran focuses on performance optimization in multi-cloud environment. The problem is described as a multi-criteria optimization problem that is handled by a group of logical rules with regards to users requirements.

The paper “Effective Computation Resilience in High Performance and Distributed Environments” by Ladislav Hluchý, Giang Nguyen, Ján Astaloš, Viet Tran, Viera Šipková and Minh Nguyen presents an effective computation resilience for complex simulations in high performance and distributed environments. A new conceptual framework is introduced that is intended to allow independent collaborations between the domain experts as end-users and providers of computational power by taking on all the deployment troubles arising in a given computing environment.

A large part of the research that uses parallel computing is oriented to modelling of complex natural phenomena, specifically to simulation of the spread of fire and smoke.

The paper “Parallel Computation of Smoke Movement During a Car Park Fire” by Peter Weisenpacher, Jan Glasa and Ladislav Halada deals with a problem of smoke movement in a car park fire. The results of series of high performance parallel simulations of several car park scenarios are presented here. The simulations are based on calculations that include the geometry of a large car park as well as the detailed geometry of burning cars. The simulations describe behaviour of smoke for fire scenarios with different numbers of parked cars and ventilation configurations.

The paper “Dedicated Hardware for Complex Mathematical Operations” by Peter Malík reports new hardware implementations for efficient computation of division, natural logarithm and exponential function. The presented implementations are designed with the high computation speed and throughput. They are oriented to high computation demanding signal processing applications.

The paper “Development of the Slovak HMM-Based TTS System and Evaluation of Voices in Respect to the Used Vocoding” by Martin Sulír, Jozef Juhár and Milan Rusko describes the development of a Slovak text-to-speech (TTS) system, which applies a technique where speech is directly synthesized from hidden Markov models (HMM). Recent statistical parametric speech synthesis method are implemented and evaluated. A set of text-to-speech systems for the Slovak language with a very good intelligibility and good naturalness of utterances at the output is presented in the paper as well.

A large part of the research at the institute applies artificial intelligence methods for various problems.

The paper “Artificial Intelligence Aggregating Opinions of a Group of People” by Marek Bundzel, Jozef Lacko, Iveta Zolotová, Tomáš Kasanický and Ján Zelenka applies methods from collective intelligence into a problem of aggregating opinions of a group of people. The suggested opinion aggregation method is based on machine learning meta-algorithm.

By this special section, we would like to thank all our partners and supporters. We wish the Institute a lot of new creative ideas and success in the quest for new knowledge and scientific findings.



Ivana BUDINSKÁ is the Director of II SAS and also the Head of Modelling and Simulation of Discrete Processes Department at II SAS. She is a supervisor and consultant for Ph.D. study at the Slovak University of Technology in Bratislava. Her research interests include discrete systems modelling and simulation, multi agent systems, artificial intelligence, complex systems, and system theory. Recently she has oriented on application of bio-inspired methods on various domains, e.g. manufacturing, production lines optimizations, supply chain management, control and coordination of a group of mobile agents. She is an author and co-author of more than 100 research papers with above 120 citations.



Ladislav HLUCHÝ is the Vice-Director of II SAS and also the Head of the Department of Parallel and Distributed Computing at the Institute. He received his M.Sc. and Ph.D. degrees, both in computer science. He is R&D Project Manager, Work-Package Leader and Coordinator in a number of 4th, 5th, 6th and 7th EU FP projects, as well as in the Slovak R&D projects (VEGA, APVT, ŠPVV). His R&D topics are focused on distributed computing, large scale applications and knowledge engineering. He is a member of IEEE, e-IRG, EGI Council, the Editor-in-Chief of the CC journal Computing and Informatics.

He is also author and co-author of scientific books and numerous scientific papers; he has more than 300 contributions and invited lectures at international scientific conferences and workshops. He is a supervisor and consultant for Ph.D. study at the Slovak University of Technology in Bratislava.