

REPORT OF 32nd INTERNATIONAL CONFERENCE 2025 CYBERNETICS & INFORMATICS (K&I)

Mikulov, Czechia, February 2-5, 2025

**organised by
Slovak Society of Cybernetics and Informatics**

**under the auspices of
Faculty of Electrical Engineering and Information Technology,
Slovak University of Technology in Bratislava, Slovakia**



The conference focuses on presentation of latest development in control engineering, information technologies and related multidisciplinary fields in line with current development trends in Industrial Internet of Things (IoT). The conference provides a general forum for researchers, university teachers and users dealing with practice of control and Information Communication Technologies (ICT).

Conference papers may range from theoretical works to engineering applications. This conference is held every two years, changing various places in Slovakia and Czechia countries. The next event should take place in 2027.

Papers are invited within the following fields:

- Methods and algorithms for modelling and control.
- New information and communication systems.
- Embedded, distributed and networked control systems.
- Cyber-physical systems, cloud computing, Big Data and extended reality.
- Artificial Intelligence.



The IEEE conference 2025 CYBERNETICS & INFORMATICS (K&I'25) held in Mikulov, Czechia from January 2nd to January 5th 2025 is at the same time the 32nd International conference CYBERNETICS AND INFORMATICS traditionally organized since 1967 by the Slovak Society for Cybernetics and Informatics at the Slovak Academy of Sciences (SSKI), the national representative of Slovakia in the International Federation of Automatic Control (IFAC) and the European Association for Artificial Intelligence (EurAI). Conference webpage and proceedings:

<https://ki2025.sski.sk/>

<https://ieeexplore.ieee.org/xpl/conhome/10915751/proceeding>

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The K&I'25 conference is organized in cooperation with the Faculty of Electrical Engineering and Information Technology of the Slovak University of Technology in Bratislava, Institute of Informatics at the Slovak Academy of Sciences and supported by important Slovak companies engaged in the research, development and application of complex control systems, informatics and communications, IoT and artificial intelligence.

The conference focuses on presentation of advanced control methods and algorithms, their integration into modern plants with the support of information and communication systems, soft computing and virtual and augmented reality techniques. The aim is to provide a general forum for researchers, university teachers and users dealing with practical problems of control and ICT.

The K&I'25 conference attendees were researchers and teachers from Bulgaria, Czech Republic, Slovak Republic, South Korea and Qatar.

We believe that the IEEE conference 2025 CYBERNETICS & INFORMATICS (K&I'25) significantly contributed to the exploitation and dissemination of research and development results in automation, cybernetics, mechatronics, informatics and communication technologies, to increase the professional level of its attendees and support their scientific work.

We would like to thank all attendees for their inspiring contributions, participation in the conference and fruitful professional as well as informal discussions.



Invited Talks of the K&I Conference

■ Petri Nets and Object-Centric Processes in Software Engineering

Gabriel Juhás

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Abstract: In this plenary talk, we discuss the role of Petri Nets and Object-Centric Processes in recent development of Software Engineering. Namely, we illustrate how extended Petri nets can be used to define a low-code language for modelling and development of software systems and web applications based on object-centric processes. Among others, we define key requirements for a low-code language for object-centric processes with forms. Such a language should enable to model object-centric processes consisting of data attributes, the life cycle of data attributes given by a workflow of tasks, and forms linked to these tasks consisting of subsets of data attributes. In addition, we specify requirements for handling events related to artifacts of object-centric processes, namely process instances, data fields, and tasks, resulting in a class of discrete event systems. We also discuss how roles specifying which users can trigger events should be represented within such a language. Finally, we outline requirements for a query language capable of searching on object-centric processes and their tasks. We also provide a prototype of such a language based on Petri nets enriched by data attributes, called Petriflow. Finally, we give an illustrative example of an application implemented using presented low-code language Petriflow.

■ Adapting Technology to the Post-Quantum and Hybrid Warfare Era: Key Research Trends and the Role of the 6G PHYSEC Project

Peter Farkaš

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Slovak University of Technology in Bratislava, Slovakia

Abstract: This plenary talk addresses the primary challenges of adapting digital technologies to the post-quantum era in connection with development of 6G infrastructures. Particularly it highlights the research problems in the area of 6G massive machine-type communication security, as well as the protection of information in cloud environments. The talk outlines current research trends that aim to mitigate these challenges and pave the way for the successful implementation of 6G technologies. These include:

- Regeneration coding for cloud systems.
- Physical layer security.
- Integrated sensing and communication.
- Quantum key distribution.
- Quantum communication.

Finally, the objectives of the COST Action CA22138 project, titled Physical Layer Security for Trustworthy and Resilient 6G Systems (6G PHYSEC), will be presented. The project aims to address several of the aforementioned challenges and contribute to the development of secure and resilient 6G systems.

