

Applications of mathematical nonlinear control theory

Special session at

**The 16th Conference
Control in Power Electronics and Electric
Drives - "SENE 2023"**

<https://sene.p.lodz.pl>

Łódź, November 22-24th, 2023

organized by: **INSTITUTE OF AUTOMATIC
CONTROL, LODZ UNIVERSITY OF
TECHNOLOGY**

Session is organized by Jacek Kabziński (jacek.kabzinski@p.lodz.pl) and Witold Respondek (witold.respondek.1@p.lodz.pl), Institute of Automatic Control, Lodz University of Technology

Recent years have brought intensive development of the mathematical theory of non-linear control, mainly (though not exclusively) in the field of

- geometrical methods of linearization of nonlinear systems via static or dynamic feedback
- Lyapunov-theory-based nonlinear control (control-Lyapunov-function-based controllers, backstepping and adaptive backstepping, nonlinear model-following control, adaptive nonlinear control),
- sliding-mode control,
- passivity-based control (PBC),
- nonlinear model predictive control (MPC),
- control based on nonlinear fuzzy and/or neural modelling,
- nonlinear observers and adaptive observers,
- optimal control or guaranteed-cost control.

Each of these approaches is subject to specific assumptions and limitations that are not always met in real objects and control systems. Nevertheless, practical applications of non-linear control theory are becoming more and more common and concern various areas of engineering.

The session is devoted to the presentation of applications of the mathematical theory of non-linear control, primarily (though not exclusively) in the areas of:

- electric drive automation,
- motion control,
- robotics,
- automotive applications,
- control of energy conversion systems,
- power electronic converters,
- industrial automation.

We invite you to present successful applications of non-linear control methods, but also to present papers critically assessing the impact of factors occurring in real control systems on the possibility of applying the theory of non-linear control in practice.

The invitation to contribute to the session is addressed to regular participants of the SENE conferences, specialists in the field of electric drive, power electronics and energy conversion systems, as well as to researchers dealing with the theory of non-linear control who would like to comment on achievements of this theory in the context of applications.

Please, submit papers in accordance with the general rules of the SENE conference. The conference does not require the transfer of copyright. The organizers of the session will endeavour to propose the publication of extended conference papers in leading scientific journals in the field of theory and applications of non-linear control.

Witold Respondek received his Ph.D. degree from the Institute of Mathematics, Polish Academy of Sciences in 1981. He has had positions at the Warsaw University of Technology and at the Polish Academy of Sciences. In 1994-2022 he was a professor of applied mathematics at the Normandie University, INSA de Rouen, France, and since 2022 he has been a professor at the Institute of Automatic Control, Lodz University of Technology. General areas of his scientific interest are geometric methods in systems and control theory as well as geometric methods in differential equations. His research papers have been devoted to problems of linearization of nonlinear control systems, nonlinear observers, classification of control systems and vector distributions, dynamic feedback, applications of high gain feedback to nonlinear systems, and systems invariant on cones. Recently he has been working on mechanical control systems and on flatness and its applications, with particular emphasis on systems with nonholonomic constraints, and on geometry of optimal control problems. He has been an associated editor of SIAM Journal on Control and Optimization, *Applicaciones Mathematicae*, *Central European Journal of Mathematics*, *Journal of Geometric Mechanics*, and *Archives of Control Sciences*.

Jacek Kabziński was appointed as a professor at the Institute of Automatic Control, Lodz University of Technology, in 1995, and is currently the head of the Control Theory Division. He has been serving as a committee member for numerous international conferences and as the editor and a reviewer for many scientific journals, including *IEEE Transactions*, *ISA Transactions*, and *Mathematical Reviews*. He is a member of the American Mathematical Society and a senior member of the IEEE. He had been the chair of the IEEE Control Systems Society, Polish Chapter, for two terms. His current research interests are in the theory of robust and adaptive control, as well as artificial intelligence methods for modeling, control, and smart computing. He is interested in industrial applications of those methods, mostly in mechanical and electrical engineering, with a special interest in electric drive controllers.

The 16th Conference

Control in Power Electronics and Electric Drives - "SENE 2023"

Łódź, November 22-24th, 2023

organized for **30 years** by:

**INSTITUTE OF AUTOMATIC CONTROL, ŁÓDŹ
UNIVERSITY OF TECHNOLOGY**

under the auspices of the Committee on Electrical Engineering Polish Academy of Sciences with the support of IEEE Polish Section and PTETIS Łódź branch

The conference covers all topics related to power electronics and electric drives, in particular:

- control methods for drive automation and power electronics,
- elements of control theory, methods of artificial intelligence and computer science inspired by applications in drive systems and power electronics,
- analysis, synthesis, modelling, simulation, and special topics of DC/AC converter drives,
- applications in robotics,
- traction drives and motion control applications,
- electrical machines,
- network control of distributed power systems or multi-drive systems,
- electromagnetic compatibility,
- reactive power compensation and other energy issues,
- redundant power supply,
- innovative applications of power electronics,
- diagnostics and education in the field of power electronics, drives and control,
- components for power electronics systems.

The SENE'23 Program Committee consists of recognized scientists, professors, representing all Polish centers conducting research in the field of power electronics and automation of electric drives.

The Program Committee invites you to submit papers for the SENE'23 conference in two categories:

- **Regular papers**

A regular paper presents the results of original research work, following generally accepted standards in the discipline of Automatic Control, Electrical Engineering, and Electronics. Submitted articles will be reviewed by the Scientific Committee according to the requirements of the editors of the 'Przegląd Elektrotechniczny' journal (ISSN 0033-2097, 2449-9544).

Subject to an appropriate copyright declaration and positive reviews of the Program Committee, considering changes and additions made by the Authors after the conference, the paper will be accepted for publication in the PE and published in one of the first issues in the year 2024. The Program Committee maintains contact with the editorial offices of The Archives of Electrical Engineering and The Bulletin of the Polish Academy of Sciences: Technical Sciences, which will accept its recommendations regarding the publication of selected papers as a special section.

- **Short papers – late-breaking results**

A short paper describes preliminary research results, hypotheses, or research plans. It should include the title, author information, keywords, abstract, and bibliography. It aims to present an interesting topic, yet unpublished, for discussion at the conference. Following review, each short paper will be included in the conference proceedings and should be presented during the conference.

Competition for young scientists

The Program Committee will award the traditional prize sponsored by IEEE Poland Section for the best work presented by a young author at SENE'22. The Scientific Committee awards the prize based on, inter alia: opinions of reviewers, assessment of the session chairman, and acclaim by conference participants.

Each submitted paper will be published in the conference proceedings, issued electronically with an ISBN.

Plenary speakers

Expected plenary speakers are:

Petros Karamanakos, Tampere University,

Zbigniew Kaczmarczyk, Silesian University of Technology,

Tianyou Chai, Northeastern University, Shenyang.

Special session and tutorials

Current information can be found on the conference website.

Registration

For conference registration and papers submission, please refer to the conference website sene.p.lodz.pl

The conference fee includes complete participation package, full board and accommodation starting from lunch on Wednesday till lunch on Friday.

Deadlines

- Papers submission by **31.07.2023**
- Preliminary information on paper acceptance **5.09.2023**
- Deadline for submission of revised articles **19.09.2023**
- Conference fee payment by **15.09.2023**

Place:

The conference is always organized in Łódź.

Organizing committee:

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