

- 2023 - NEWSLETTER

DEPARTMENT OF INFORMATION ENGINEERING AND PROCESS CONTROL

Fellow colleagues, partners, and friends,

As the year nears its end, it is time to reflect on our achievements. In the year, we continued strengthening our scientific reach by organizing the Process Control 2023 conference under the auspices of IEEE and IFACx, followed by a successful bid to organize DYCOPS 2025. The deliverables of the project FrontSeat significantly boosted our internal development with several lectures by international guests. Congratulations go also to our master's students, who successfully defended their theses before an international committee, which was organized for a first time in our history.

Dr. Martin Klaučo
Head of the department

Yearly Updates

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IAM (Institute of Information Engineering, Automation, and Mathematics) Students Received Rector's and Dean's Awards



Ing. Michaela Horváthová, PhD. - STU Rector's Award for excellent performance of study obligations throughout the post-graduate studies

Ing. Lenka Galčíková - Dean's Award for extraordinary fulfillment of school duties and activity for the benefit of the faculty

Ing. Martina Bujdáková - Dean's Award for excellent results during the graduate studies and results achieved in the student scientific and technical activities

Ing. Patrik Valábek - STU Rector's Award for excellent performance of study obligations throughout the graduate studies and Dean's Award for excellent results during the graduate studies and results achieved in the student scientific and technical activities

Ing. Jozef Vargan - Dean's Award for excellent results during the graduate studies and results achieved in the student scientific and technical activities

Bc. Matej Ružička - STU Rector's Award "Student of the Year" for an important representation of STU in sports

Matúš Krivošík - Dean's Award for representation of faculty in sports

IAM Students Awarded for the Best Master Thesis

Students who defended their outstanding master thesis were awarded for their hard work and dedication. Among those few chosen, six IAM students received special awards from our industrial partners. **Ing. Petronela Belková** (Thermo Fischer), **Ing. Martina Bognár** (Actemium), **Ing. Martina Bujdáková** and **Ing. Patrik Valábek** (Humusoft), **Ing. Jozef Vargan** (REPAR - Building Control) and **Ing. Samuel Záhorčák** (Siemens).





On 12 October, a ceremony was held to announce the winners of the ESET Science award, who were selected by an international expert committee from among 15 finalists. One of the finalists in the category Outstanding personality of science under the age of 35 was our colleague **doc. Ing. Martin Klaučo, PhD.** Congratulations and thank you for the worthy representation of our institute!



As part of the Week of Science and Technology, the Ministry of Education, Science, Research and Sport of the Slovak Republic awarded the Awards for Science and Technology for the year 2023. **doc. Ing. MSc. Martin Klaučo, PhD.**, received the Award for Science and Technology in the category Science and Technology Personality Under the Age of 35 for his merits in the field of optimal process control and applied cybernetics and contributing to the long-term sustainability of industrial production.

Journal Papers

R. Mitze – M. Kvasnica – M. Mönnigmann:

Exploiting symmetries in active set enumeration for constrained linear-quadratic optimal control.

Automatica, pp. 1 – 8, 2023.

R. Dyrská – M. Horváthová – P. Bakaráč – M. Mönnigmann – J. Oravec:

Heat exchanger control using model predictive control with constraint removal.

Applied Thermal Engineering, 2023.

M. Furka – M. Kalúz – M. Fikar – M. Klaučo:

Guidelines for Secure Process Control: Harnessing the Power of Homomorphic Encryption and State Feedback Control.

IEEE ACCESS, 2023.

M. Mojto – K. Ľubušký – M. Fikar – R. Paulen:

Data-Based Design of Multi-Model Inferential Sensors.

Computers & Chemical Engineering, 2023.

K. Ng – N. Alygizakis – M. Nika – A. Galani – P. Oswald – M. Oswaldova – Ľ. Čirka – U. Kunkel – A. Macherius – M. Sengl – G. Mariani – S. Tavazzi – H. Skejo – B. M. Gawlik – N. S. Thomaidis – J. Slobodník:

Wide-scope target screening characterization of legacy and emerging contaminants in the Danube River Basin by liquid and gas chromatography coupled with high-resolution mass spectrometry.

Water Research, 2023.

N. Alygizakis – K. Ng – N. Maragou – S. Alirai – P. A. Behnisch – H. Besselink – P. Oswald – Ľ. Čirka – N. S. Thomaidis – J. Slobodník:

Battery of In Vitro Bioassays: A Case Study for the Cost-Effective and Effect-Based Evaluation of Wastewater Effluent Quality.

Water, 2023.

IAM Students Defended Their Master Theses



On May 30, the defense of master's thesis were held at IAM. The following students successfully defended their diploma theses: **Ing. Petronela Belková, Ing. Martina Bognár, Ing. Martina Bujdáková, Ing. Matej Hatványi, Ing. Michal Holub, Ing. Katrin Kvasnicová, Ing. Tímea Mészárosóvá, Ing. Zuzana Mošková, Ing. Monika Špaková, Ing. Patrik Valábek, Ing. Jozef Vargan and Ing. Samuel Záhorčák.** Congratulations to all students and we wish you many more successes.

IAM Students Defended Their Bachelor's Theses

On June 20, the defense of bachelor's theses was held at IAM. The following students successfully defended their bachelor's theses: **Bc. Dinara Bazarkhanova, Bc. Branislav Daráš, Bc. Viktória Koncserová, Matúš Krivošík and Bc. Kateryna Kruhliak.**

Congratulations to all students and we wish you many more successes.



IAM PhD Students Passed the Dissertation Examination



On February 24, the dissertation exams of doctoral students were held at IAM. Part of the dissertation exam was the defense of a written thesis. The dissertation exam was defended by **Ing. Tereza Ábelová** and **Ing. Diana Dzurková**.

Also on June 12, the dissertation exams of doctoral students were held at IAM. Part of the dissertation exam was the defense of a written thesis. The dissertation exam was defended by **Ing. Rastislav Fáber**, **Ing. Erika Pavlovičová** and **Ing. Marek Wadinger**.

PhD Students Successfully Defend Their Dissertation Thesis

On August 18, defenses of dissertation thesis took place at the IAM. **Ing. Michaela Horváthová PhD.** and **Ing. Martin Mojto PhD.** successfully defended their dissertation thesis.

Ing. Michaela Horváthová, PhD. defended her dissertation on “Energy-Efficient Advanced Robust Control Design”. The supervisor of this work was doc. Ing. Juraj Oravec, PhD.

Ing. Martin Mojto, PhD. defended his dissertation on “Data-driven Design of Linear Soft Sensors”. The supervisor of this work was doc. Ing. Radoslav Paulen, PhD.

We heartily congratulate you and wish you much success in your future work and personal life.



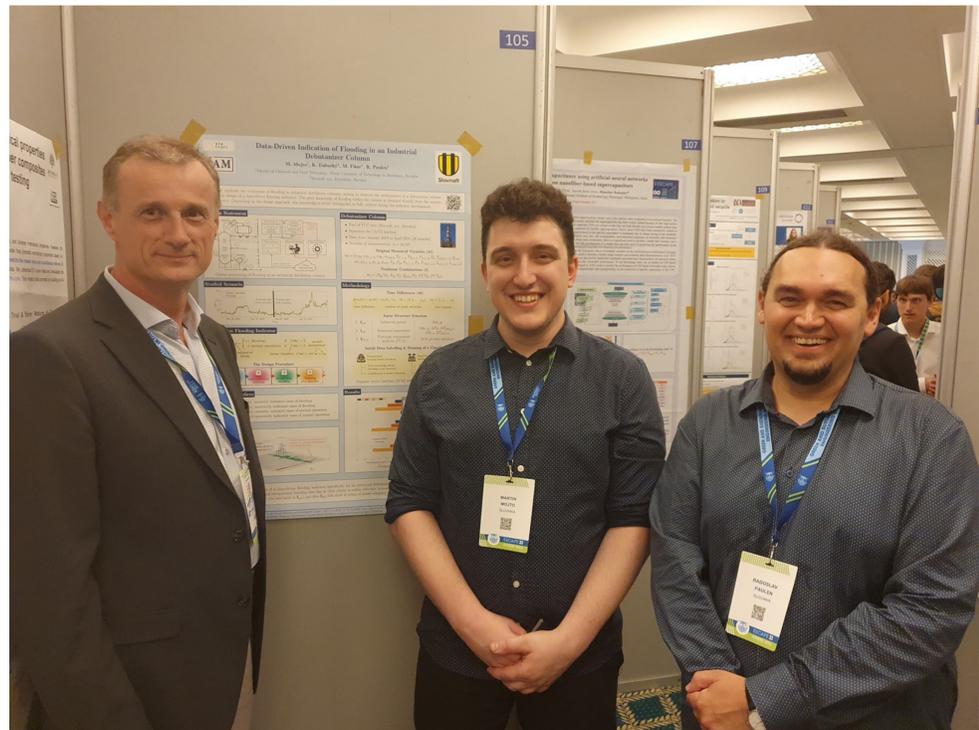
Conference Papers



On May 15-18, the **49th international Conference of the Slovak Society of Chemical Engineering SSCHE 2023** was held in Tatranské Matliare. Ing. Rastislav Fáber, Ing. Martin Mojto and doc. Ing. Radoslav Paulen, PhD. participated in this event.



On June 6-9, after four years, we met again with our colleagues interested in process control at our **24th International Conference on Process Control 2023** in the High Tatras. The objective of the conference was to bring together theory experts and control systems practitioners, to evaluate the new avenues for techniques, design procedures and instruments in process control. Contributions range from theoretically rigorous research works to industrial applications. In addition to participants from Slovakia, the conference was attended by researchers from the Czech Republic, Hungary, Austria, Germany, Italy, Norway, France, and Mexico.



On June 18-21, the 33rd **European Symposium on Computer-Aided Process Engineering (ESCAPE-33)** was held in Athens, Greece. On behalf of the IAM, the conference was attended by prof. Ing. Miroslav Fikar, DrSc., doc. Ing. Radoslav Paulen, PhD., and Ing. Martin Mojto.



On July 9-14 was held the **22nd International Congress Federation of Automatic Control (IFAC)** in Yokohama, Japan. IAM was attended by prof. Ing. Miroslav Fikar, DrSc., doc. Ing. Martin Klaučo, PhD., doc. Ing. Juraj Oravec, PhD., doc. Ing. Radoslav Paulen, PhD., Ing. Peter Bakaráč, PhD., Ing. Tereza Ábelová, Ing. Kristína Fedorová, Ing. Michaela Horváthová, Ing. Karol Kiš, Ing. Roman Kohút, Ing. Martin Mojto and Ing. Erika Pavlovičová.

International Projects



The project aims at increasing the research and academic prospects of Slovak University of Technology in Bratislava, Slovakia (STUBA). This year we started to work closely with two renowned research groups in automatic control from RU Bochum, Germany (RUB) and Pisa University, Italy (UNIFI). Below is the photo from the meeting during 24th International Conference on Process Control 2023.



The specific goals of the action are to reinforce the collaboration with the two research groups from Western Europe, to intensify research in advanced automatic control, to open up new collaboration channels through academic and industrial networking, to train excellent young/senior researchers and project managers, and to effectively disseminate and exploit the research results of STUBA.

front-seat.eu



Visit the [official website](http://front-seat.eu) and subscribe to the project newsletter on the bottom of the page.

International Projects

Twinning 101079342 – **FrontSeat**: Fostering Opportunities Towards Slovak Excellence in Advanced Control for Smart Industries (**M. Fikar**)

Mobility of students and university employees between program countries and partner countries (STU - Thailand) (**R. Paulen**)

National Projects

APVV: Data Based Process Control (**M. Fikar**)

APVV: Energy-efficient Safe and Secure Process Control (**M. Kvasnica**)

VEGA: Economically Efficient Predictive Control of Microgrids (**M. Kvasnica**)

VEGA: Controller design methods for low-level carbon footprint process automation (**J. Oravec**)

VEGA: Efficient control of industrial plants using data (**R. Paulen**)

VEGA: Advanced Control of Energy Intensive Processes with Uncertainties in Chemical, Biochemical and Food Technologies (**M. Klaučo**)

Program to Support Excellent Teams of Young Researchers: Design of Optimal Controllers for Industrial Microprocessors (**M. Horváthová**)

Young Researcher:

- Optimization of Mathematical Model for an Industrial Distillation Column (**M. Mojto**)
- Secure Measurement Processing in the Chemical Industry (**M. Furka**)
- Computationally Efficient Optimal Control of Chemical-technological Processes (**L. Galčíková**)
- Process Control Using Artificial Intelligence Methods (**K. Kiš**)

Seminars and Workshops

This year an extraordinary amount of seminars and workshops were held. We organized and participated at more than 38 of these events, and allow us to mention a few:



On February 28, the first seminar “Academia Meets Industry” was held in the premises of the Faculty of Electrical Engineering and Informatics of STU, aimed at increasing the excellence of STU within the framework of cooperation with industrial partners. The event was part of the FrontSeat project.



On June 13, we organized a scientific seminar on “The Use of PLC for sequential control applications”. The seminar was led by Paisan Kittisupakorn and Sirikanya Singcuna, both from the Department of Chemical Engineering, Chulalongkorn University, Bangkok, Thailand. The scientific seminar was organized in the framework of the FrontSeat project as part of the seminar series on “Research Seminar on Smart Cybernetics”.



On March 10, we organized a scientific seminar on “Systems Identification Algorithms and Software Tools for the Application of MPC in Process Control Systems”. The scientific seminar was led by Gabriele Pannocchia, a professor at the University of Pisa. The scientific seminar was organized in the framework of the FrontSeat project as part of the seminar series on “Research Seminar on Smart Cybernetics”.



On May 22-24, the second workshop dedicated to the use of advanced technologies in education took place at the IAM. The workshop was organized in cooperation with the Faculty of Mining, Ecology, Control and Geotechnology of the Technical University in Košice.

Seminars and Workshops



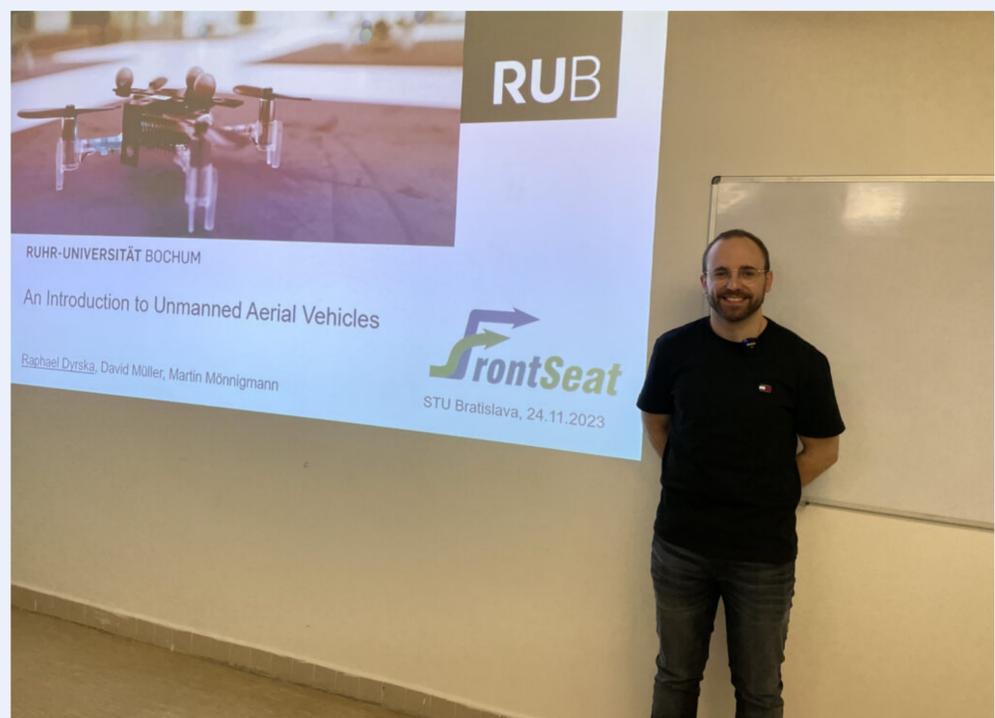
On August 22, we organized a scientific seminar on “Teaching ‘recursive stability’ of MPC to engineering students“. The scientific seminar was led by Martin Mönnigmann, a professor at Ruhr-Universität Bochum, Germany. The scientific seminar was organized in the framework of the FrontSeat project as part of the seminar series on “Research Seminar on Smart Cybernetics”.



On November 9, we organized a scientific seminar on “Valve Stiction and MPC: A Long Sticky and Freaky Journey“. The scientific seminar was led by Riccardo Bacci di Capaci, an assistant professor at the University of Pisa, Italy. The scientific seminar was organized in the framework of the FrontSeat project as part of the seminar series on “Research Seminar on Smart Cybernetics”.



On November 14, we organized a scientific seminar on “Embedded Implementation of a Neural Network Controller Emulating Nonlinear MPC in a Process Control Application“. The scientific seminar was led by Sebastian Leonow, a lecturer at Ruhr University Bochum. The scientific seminar was organized in the framework of the FrontSeat project as part of the seminar series on “Research Seminar on Smart Cybernetics”.



On November 24, we organized a scientific seminar on “An Introduction to Unmanned Aerial Vehicles“. The scientific seminar was led by Raphael Dyrška, a PhD student at Ruhr University Bochum. The scientific seminar was organized in the framework of the FrontSeat project as part of the seminar series on “Research Seminar on Smart Cybernetics”.

Excursions to Industry



Ing. Richard Valo, PhD. organized several excursions to industrial plants for our students. On March 10w, the students had a look behind the gates of **OLO a.s.**, where they got to know the ways of sorting and processing waste. On April 14 students visited two industrial establishments. The first was **MONDI SCP a.s.** Subsequently, they moved to **Tesla Liptovský Hrádok a.s.**

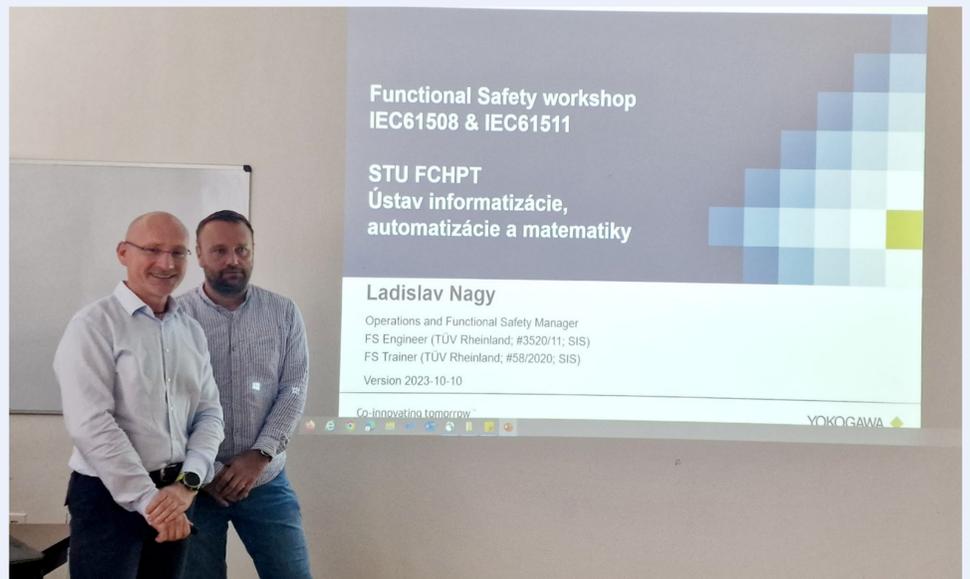
Training in the Training Center



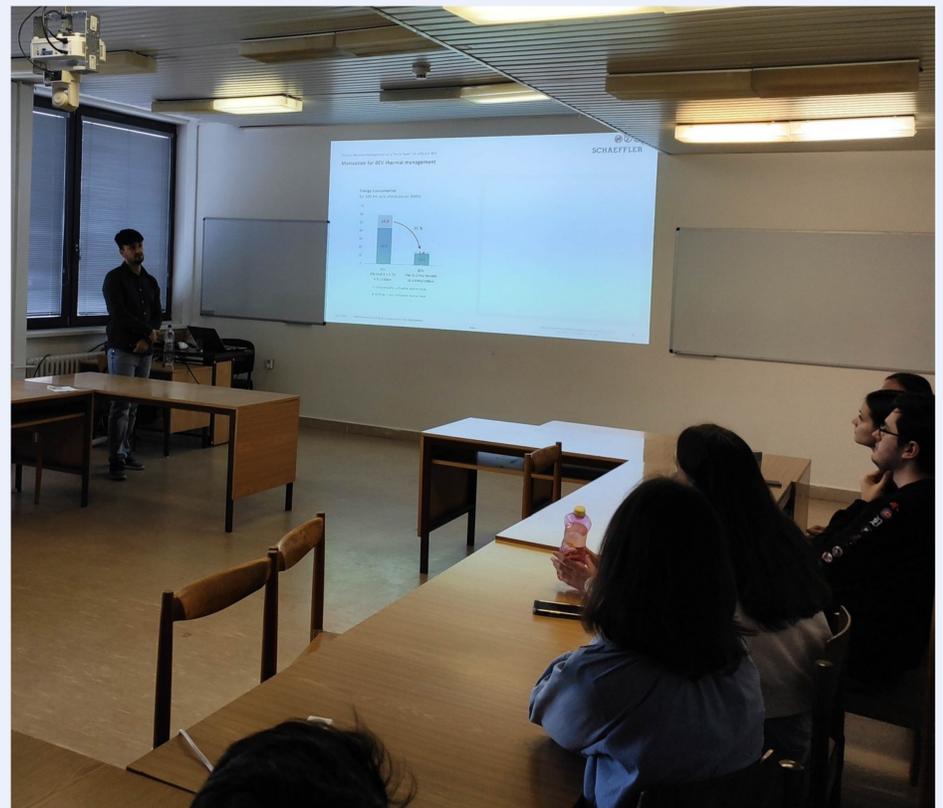
Students of the fifth grade within the subject Process Control Project graduated on the October 18-20 training at the **Unipetrol Training Center in Litvínov**, Czech Republic.

The training focused on the control of real processes and was led by experienced practitioners. The students thus acquired new knowledge and skills that will help them in solving problems in their future job.

Educational Lectures from Industry



On October 10, we organized a lecture on functional safety for our students within the course on Theory of automatic control and Technical means of automation. The lecture was led by representatives from **Yokogawa** companies - Ing. Ladislav Nagy and **Actemium** - Ing. Miloš Pinka.



On November 13, we had the opportunity to welcome our graduate **Ing. Michal Mateáš** from **Schaeffler Slovensko, s.r.o.** at a guest lecture within the masters study subject "Modeling in the process industry".

The topic of the lecture, "Mathematical modeling as a cornerstone in the product development", revealed to us how modeling contributes to the effective thermal control of the drive system of electric vehicles.

Learn about Automation



IAM participating at CHEMSHOW at FCHPT STU - Open Day, which took place on June 27 in Bratislava. Visitors from many high schools could try interesting practical demonstrations of automation and process control at our IAM stands.



On September 29, we participated in the European Night of Researchers. Thousands of visitors could try practical demonstrations of automation and process control at our IAM stand at FCHPT of STU in Bratislava.

We are very pleased with the high interest in our display, where visitors could learn about the development of our VESNA smart greenhouse. Participants could grasp the fundamental principles of process control by manipulating the airflow in the FlexyAir device, which impacted the position of the floater in the tube.



On September 6, STU opened its doors to the 13th year of the Summer University for high school students. During the first day at the university, the students also visited our laboratories, where they learned interesting things about the control of chemical-technological processes, but also about the development of our intelligent greenhouse VESNA.



IAM cooperates in scientific research, as well as, in supporting talented students with the following companies:



Social media contest with Humusoft and Matlab Academy

Students may periodically win motivational items (smart watches and interesting promotional items) from HUMUSOFT when they present a certificate from the MATLAB-ACADEMY self-paced online courses. As part of the MATLAB - STU Campus-Wide License, all STU students have access to a wide range of professionally prepared online courses. They can take a course in linear algebra, solving differential equations, programming, machine learning and much more.





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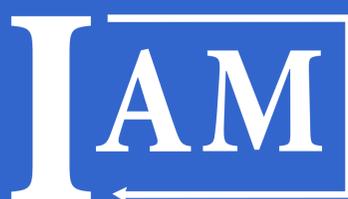
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