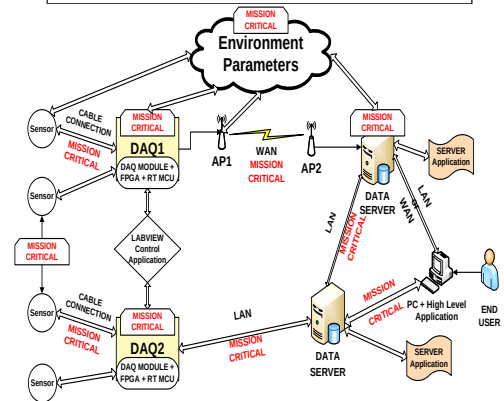
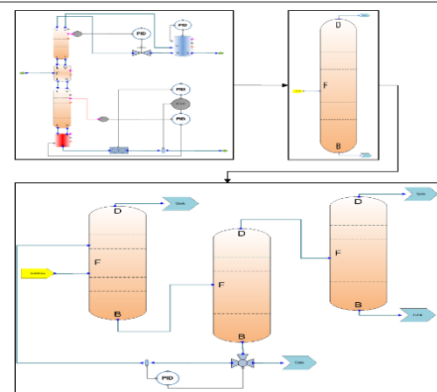


PROCESS AND ENERGY SYSTEMS ENGINEERING

Contact details

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Areas of expertise

Process modelling and simulation: First principle modelling; Gray box modelling with partial derivative equations; Neural networks

Process control: Plantwide control, Control strategies for unconventional processes (e.g. cryogenic separation units, heavy water production); Development of control algorithms for processes with distributed parameters; System identification technologies, Dedicated control solutions for: rotary hearth furnaces, blunting systems, rolling mills, piercers and storage tanks, Intelligent control; Fractional-order control; Artificial intelligence applications

Energy systems: Renewable energy systems; Nuclear power plants; Laser, plasma and electron irradiation processes; Steam power plants

Medical systems: Pandemic dynamics; Respiratory system; Dental systems

Buildings automation: Energy efficiency and environmental parameters control (Certifications: SIEMENS: Synco 700 ACS Engineering; KNX; Security Systems)

Team

Prof. Dr. Eng. Mihail Abrudean, Prof. Dr. Eng. Tiberiu Coloși, Prof. Dr. Eng. Vlad Mureșan, Assoc. Prof. Dr. Eng. Ionuț Muntean, Assoc. Prof. Dr. Eng. Iulia Clitan, Senior Lecturer Dr. Eng. Valentin Ioan Sita, Asist. Eng. Laurențiu Chifor, Ph.D. Student Eng. Cristina Stăncioi, Ph.D. Student Eng. Roxana Motorga, Ph.D. Student Eng. Iulian Badea, Ph.D. Student Eng. Flavius Popa, Ph.D. Student Petru Urs, Ph.D. Student Georgel Filip Imre, Ph.D. Student Georgel Săveanu

Representative projects

“Dynamics of SARS-CoV-2 virus transmission in Romania” - granted by UEFISCDI (no. 10Sol/2020). Project period: 2020 - 2021. The team structure: Coordinator: Technical University of Cluj-Napoca; P1 partner: "Alessandrescu-Rusescu" National Institute for Maternal and Child Health, Bucharest; P2 partner": Cluj-Napoca Infectious Diseases Clinical Hospital

“Embedded mode for advanced pressure control in protected spaces”, PNIII-CI-2017

“Optimizing the length of steel bars according to the process of programming the production of tubular material and in relation to the production process in the steel works” internal project funded by TUCN (2016-2017)

“Stimulation of the return curve (metallographic process)”, internal project funded by TUCN (2016-2017)

I3E, “Promoting Innovation in the Industrial Informatics and Embedded Systems Sectors through Networking”, South East Europe Transnational Cooperation Programme (SEE), (2010-2012)

“Advanced metallurgical process control for the production of seamless steel tubes”, BD-CNCSIS, (2008-2010)

Significant results

The most representative publications of the past 5 years:

1. Vlad Mureșan, Mihaela-Ligia Ungureșan, Mihail Abrudean, Honoriu Vălean, Iulia Clitan, Roxana Motorga, Emilian Ceuca, Marius Fișcă, "AI versus Classic Methods in Modelling Isotopic Separation Processes: Efficiency Comparison", Mathematics 2021, vol. 9, no. 23: 3088, pp. 1-31. <https://doi.org/10.3390/math9233088>.

2. Roxana Motorga, Vlad Mureșan, Mihaela-Ligia Ungureșan, Mihail Abrudean, Honoriu Vălean, Iulia Clitan. "Artificial Intelligence in Fractional-Order Systems Approximation with High Performances: Application in Modelling of an Isotopic Separation Process", Mathematics 2022, 10, 1459, pp. 1-32. <https://doi.org/10.3390/math10091459>.
3. Tiberiu Coloși, Mihail Abrudean, Mihaela Ungureșan, Vlad Mureșan, "Numerical simulation of distributed parameter processes", Editura SPRINGER, 2013, 363 pagini ISBN: 978-3-319-00013-8.
4. Mureșan V, Abrudean M, „Conducerea proceselor industriale”, Editura Galaxia Gutenberg, Cluj-Napoca 2017, 181 pagini, ISBN 978-973-141-699-1.
5. Tiberiu Coloși, Iulia Clitan, Mihaela Ligia Ungureșan, Vlad Mureșan, Mihail Abrudean - Posibile extinderi ale matricei derivatelor parțiale a vectorului de stare, asociate unor categorii de ecuații cu derivate parțiale, Editura Galaxia Gutenberg, 2020, 49 pag., ISBN 978-973-141-878-0.
6. Vlad Mureșan, Mihail Abrudean, Mihaela-Ligia Ungureșan, Iulia Clitan, Tiberiu Coloși, "Intelligent temperature control in an industrial furnace", ICCAE conference, Sydney, Australia, 14-16 Februarie, 2020.
7. Vlad Mureșan, Iulia Clitan, Valentin Sita, Mihail Abrudean, Mihaela-Ligia Ungureșan, "18O Isotope Separation Process Control", Lecture Notes in Electrical Engineering book series (LNEE, volume 613), 26 Octombrie 2019.
8. Vlad Mureșan, Mihail Abrudean, "Fault Tolerant Control System of the Rotary Hearth Furnace Servicing Machines", 2019 IEEE 22nd International Symposium on Design and Diagnostics of Electronic Circuits & Systems (DDECS), 24-26 Aprilie 2019, Cluj-Napoca, România.
9. Roxana-Maria Motorga, Mihail Abrudean, Vlad Muresan, Valentin Sita, Cristian Bondici, Adrian Popescu, "Intelligent Model For A Mini Hydropower Plant And Its Adaptive Control", International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA 2024), February 01-02, 2024, Mahé, Seychelles.
10. Roxana-Maria Motorga, Vlad Muresan, Mihail Abrudean, Iulia Clitan, Mihaela Unguresan, Adrian Popescu, "Advanced control of the 13C isotopic separation process using AI", International Conference on Artificial Intelligence, Computer, Data Sciences and Applications (ACDSA 2024), February 01-02, 2024, Mahé, Seychelles.
11. Cristina-Maria Stancioi, Vlad Muresan, Adrian Popescu, Valentin Sita, "Optimizing Microgrid Stability: A Neural Network Approach with PID Control for DC/DC Converters", 2024 IEEE Conference on Artificial Intelligence (IEEE CAI 2024), June 25-27, 2024, Singapore, Singapore.
12. Cristina Maria Stancioi, Vlad Mureșan, Iulia Clitan, Mihail Abrudean, Valentin Sita, "Implementing Automatic Functionalities using an Electric Power Steering System", 2023 8th International Conference on Robotics and Automation Engineering (ICRAE 2023) and the 9th International Conference on Robotics and Artificial Intelligence (ICRAI 2023), November 17th to 19th, 2023, Singapore, Singapore.
13. Iulia Clitan, Vlad Muresan, Mihail Abrudean, Andrei Florin Clitan, Honoriu Vălean, Mihaela Ligia Ungureșan, "Comparison of Continuous and Discrete PI Control on Clamp Positioning of an Industrial Robot", 2019 23rd International Conference on System Theory, Control and Computing (ICSTCC), 9-11 Oct. 2019, Sinaia, România.
14. Vlad Mureșan, Mihaela-Ligia Unguresan, Delia Gligor, Codruța Varodi, "Neural Modeling of Lagoon Treatment for Coating of Electrodes with Mediator", COATINGS, Vol.: 9, Issue 7, 2019, Article: Number 429, ISSN: 2079-6412, DOI: 10.3390/coatings9070429, WOS:000478656200029.
15. Unguresan, Mihaela-Ligia; Muresan, Vlad; Gligor, Delia; et al., Adsorption process of phenothiazine solution in dimethyl sulfoxide on graphite electrodes Journal of Solid State Electrochemistry, Vol: 22, Issue: 8, Pages: 2305-2314.
16. Muresan, Vlad; Moga, Daniel; Petreus, Dorin; et al., Fault Detection and Fault Tolerance Mechanism for DC/DC Converters in Microgrids 10th IFAC Symposium on Control of Power and Energy Systems (CPES) Location: Meiji Univ, Tokyo, JAPAN Date: SEP 04-06, 2018 IFAC PAPERSONLINE, Volume: 51, Issue: 28, Pages: 666-671.

Significant solutions

First principle modelling library for distillation processes with non-ideal mixtures, Tuning algorithm for PID controllers for discrete-time systems with dead time, Gray box modelling platform, Control strategies for isotopic processes, Plantwide control strategies for distillation processes, Tuning algorithms for coupled PID controllers for performance improvement, Intelligent control solutions for industrial processes, Fractional-order control solutions for industrial processes, Methods for pandemic dynamics modelling, Control and implementation solutions for the buildings environmental parameters.

Products and technologies:

17. First principle modelling framework for distillation processes with non-ideal mixtures
18. General modelling and control framework using partial derivative equations
19. Robust PID tuning algorithm for discrete-time systems

The offer addressed to the economic environment

Research & development	Development of open- and closed-loop identification solutions. Development of tailored solutions for the modelling, simulation and control of chemical and energy systems. Development of general first principle modelling libraries/frameworks for chemical and energy systems. Development of general control strategies for the chemical and energy sector. Development of optimal control strategies for renewable energy systems. Development of models for biomedical applications. Development of buildings automation systems.
Consulting	System identification. Process modelling. Tuning of coupled controllers. Calculation of the economic potential of implementing advanced control strategies. Support for the implementation of our proposed technical solutions. Buildings automation.
Training	Systems theory: identification methods, stability analysis, control loops, controllers. Process control: optimal control algorithms, plantwide control, PID tuning (discrete and continuous systems), control of unconventional processes, intelligent control, fractional-order control, buildings automation. Electronics: power and basic electronics.