PROCESS AND ENERGY SYSTEMS ENGINEERING

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Acronym	**PSE**
Logo	
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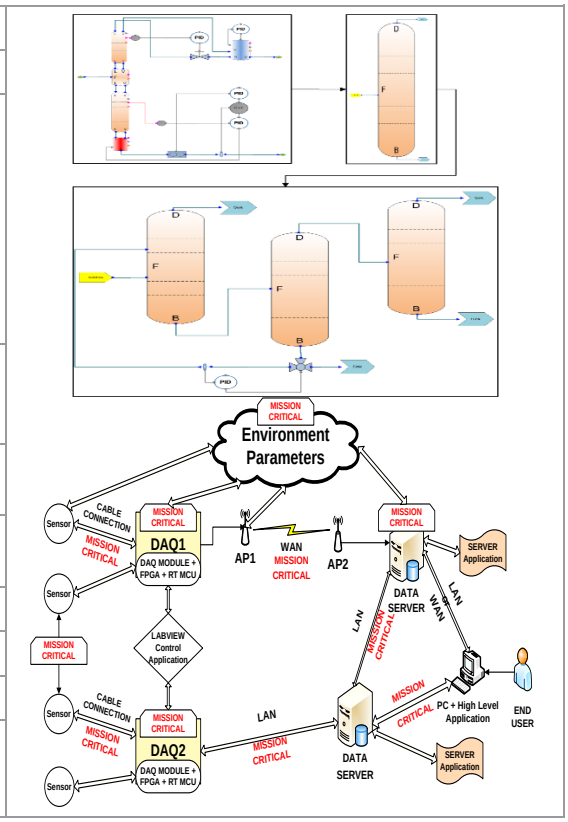

Areas of expertise

Process modelling and simulation
- First principle modelling
- Gray box modelling with partial derivative equations

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

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

Medical systems
- Respiratory system
- Dental systems

Team

Prof. Eng. Mihail Abrudean, PhD., Assoc. Prof. Eng. Vlad Mureşan, PhD., Senior Lecturer Eng. Ionuţ Muntean, PhD., Senior Lecturer Eng. Iulia Clitan, PhD.

Representative projects

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)
"Developing the ^{13}C isotope separation technology in CO2 – carbamate", PNII-Partnerships, (2007-2010)
"Control of nonlinear robust cryogenic isotope separation column ^{13}C", PNII-Partnerships, (2007-2010)
"Embedded systems for real-time network process control", PNII-Partnerships, (2007-2010)
"Research and development in automation and applied informatics", S.C. Tenaris Silcotub S.A. Zalău, (2008)
"Mobile laboratory for automation", S.C. Tenaris Silcotub S.A. Zalău, (2008)

"Convergence of information technology and automatic control methods with applications in power and energy systems", CEEX, (2005-2007)
"Developing the separation technology of ^{13}C by CO cryogenic distillation", CEEX, (2005-2007)

Significant results

The most representative publications of the past 5 years:

1. T. Coloşi, M. Abrudean, M.-L. Ungureşan, V. Mureşan, "Numerical simulation of distributed parameter processes", SPRINGER, 2013, 363 pages, ISBN: 978-3-319-00013-8.
2. T. Coloşi, M. Abrudean, M.-L. Ungureşan, V. Mureşan, "Examples of numerical Simulation for systems with distributed and lumped parameters through the Mpdx method with approximating solutions", UTPRESS, Cluj-Napoca, Romania, 2013, 98 pages, ISBN: 978-973-662-847-4.
3. V. Mureşan, M. Abrudean, T. Colosi, C. Bondici, I. Clitan, M.L. Unguresan, M. Secara, "Modeling and Simulation of a Hydroelectric Process", 6th International Conference on Aerospace, Robotics, Mechanical Engineering, Manufacturing Systems, Neurorehabilitation and Human Motricities (ICMERA), 29-31 October, Bucharest, Romania, *Applied Mechanics and Materials*, vol. 811, 2015, pp. 133 -141, Trans Tech Publications, Switzerland.
4. V. Mureşan, M. Abrudean, M.-L. Ungureşan, T. Coloşi, "Feed-forward Control of a Residual Water Blunting Process", *Journal of Control Engineering and Applied Informatics* (*CEAI*), vol. 16, no. 4, 2014, pp. 42-51, ISSN: 1454-8658.
5. V. Mureşan, M. Abrudean, M.-L. Ungureşan, T. Coloşi, "Cascade Control of a Residual Water Blunting System", *Advances in Electrical and Computer Engineering* (*AECE Journal*), vol. 14, no. 2, 2014, pp. 135-144, ISSN: 1582-7445.
6. I. Clitan, V. Muresan, M. Abrudean, "Design of a discrete controller using the Dahlin algorithm for a direct-current motor speed control", *Journal of Computer Science and Control Systems* (*JCSCS*), vol. 7, no. 2, Ed. Universității din Oradea, 2014, pp. 13-18, ISSN 1844-6043.
7. D. C. Dumitrache, I. Inoan, B. De Schutter, "An analytic model for a C-13 source isotope separation process by cryogenic distillation", in *Journal of Process Control*, 2014.
8. T. Szelitzky, I. Inoan, D. Dumitrache, " Advantages of robust control for series load frequency controlled induction heating inverters", in *Journal of Control Engineering and Applied Informatics (CEAI)*, vol. 13, no. 1, 2011, pp. 62-68.
9. C. Ionescu, I. Muntean, J.A. Tenreiro-Machado, R. DeKeyser, M. Abrudean, "A theoretical study on modelling the respiratory tract with ladder networks by means of intrinsic fractal geometry", in *IEEE Transactions on Biomedical Engineering*, vol. 57, 2010, pp. 246 -253.
10. V. Mureşan, M. Abrudean, "Temperature Simulation in the Furnace with Rotary Hearth, using Taylor Series", in *Journal of Control Engineering and Applied Informatics (CEAI)*, Vol. 12, No. 4, 2010, pp. 51-59.

Significant solutions:

1. First principle modelling library for distillation processes with non-ideal mixtures,
2. Tuning algorithm for PID controllers for discrete-time systems with dead time
3. Gray box modelling platform
4. Control strategies for isotopic processes
5. Plantwide control strategies for distillation processes
6. Tuning algorithms for coupled PID controllers for performance improvement

Products and technologies:

1. First principle modelling framework for distillation processes with non-ideal mixtures
2. General modelling and control framework using partial derivative equations
3. 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.
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.
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. **Electronics:** power and basic electronics.