


ROBOTICS AND NONLINEAR CONTROL

Contact details

Name	Robotics and Nonlinear Control
Acronym	ROCON
Logo	
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Areas of expertise

Our group works on **Robotics and Nonlinear Control (ROCON)** at the Department of Automation of the Technical University of Cluj-Napoca. Our research interests range from robot design, perception, and control; through fundamental nonlinear control, networked systems, and estimation; to machine learning, artificial intelligence, and deep neural networks. These methods are applied to marine, ground, and aerial robotics, precision agriculture, rehabilitation robotics, and so on.

Team

Professors: Lucian Busoniu, group lead; Zsófia Lendek, Levente Tamas; Gheorghe Lazea, honorary member
Assistant Professors: Alexandru Codrean, Tassos Natsakis, Cosmin Marcu
Teaching assistants and postdocs: Zoltan Nagy, Mircea Susca
PhD and long-term research students: Bilal Yousuf, Matthias Rosynski, Tudor Santejudean, Etienne Gorski, Paul Sucala, Alexandru Pop, Ioana Lal, Florin Gogianu, Amalia Matyas, Molnar Szilard, Mihalis Maer, Ioana Ulici, Bogdan Lazar, David Rete, Tudor Alinei-Poiana, Elvin Pop, Marius Dragomir, Stefan Pirje, Radu Herzal, Davian Martinovici,
Remote-work researchers: prof.dr. Constantin Morărescu, dr. Vineeth Varma
Technician: Adrian Lucaci. Project manager: Teodora Sanislav.

Representative projects (selection of 5 recent projects)

DECIDE: AI Design of Decentralized Cooperative Control over Networks, National Resilience and Recovery Plan, component C9, investment I8, 2023-2026, PI Constantin Morarescu <https://decide.utcluj.ro/>

SeaClear2.0: Scalable Full-Cycle Marine Litter Remediation in the Mediterranean: Robotic and Participatory Solutions, Horizon Europe Innovation Action, 2023-2026, PI Lucian Busoniu, <https://www.seaclear2.eu>, see also the first iteration of the project at <https://seaclear-project.eu/>.

VinEye: cartografierea colaborativă a viilor cu roboți autonomi, PED grant, 2022-2024, PI Levente Tamas, http://rocon.utcluj.ro/~leventel/?page_id=568

Control design for optimal estimation using heterogeneous sensors (HEROES), Young Teams grant, 2021-2022, PI Zsofia Lendek, <http://lendek.net/TE185/>

Targeted Robotic UppEr-arm REHAbilitation (TRUE-REHAB). Young Teams Grant, 2020-2022, PI Tassos Natsakis, <http://rocon.utcluj.ro/true-rehab>

Significant results

Selection of 5 representative publications in the past 5 years

I. Lal, I.-C. Morărescu, J. Daafouz, L. Bușoniu, *Optimistic planning for control of hybrid-input nonlinear systems*, Automatica, 2023.

Z. Nagy, Zs. Lendek, L. Busoniu, *TS fuzzy observer-based controller design for a class of discrete-time nonlinear systems*. IEEE Transactions on Fuzzy Systems, 2022.

Frohlich R, Tamas L, Kato Z. 2019. *Absolute Pose Estimation of Central Cameras Using Planar Regions*. IEEE

Transactions on Pattern Analysis and Machine Intelligence.

H. Boey H, S. Verfaillie, T. Natsakis, J. Sloten, I. Jonkers, 2019. *Augmented Ligament Reconstruction Partially Restores Hindfoot and Midfoot Kinematics After Lateral Ligament Ruptures*. Am J Sports Med.

Zs. Lendek, Z. Nagy, J. Lauber, *Local stabilization of discrete-time TS descriptor systems*. Engineering Applications of Artificial Intelligence, vol. 67, pages 409-418, 2018.

Patents:

Automatic Obstacle Detection and Breaking System for Cars, L. Tamas, Gh. Lazea, no A10006/16.02.2011.

Metodă De Vizualizare A Traseului Unui Vehicul Autonom Folosind Realitatea Augmentata, C. Militaru, L. Tamas, L. Tofalvi, request no. A/000368/2018, patent no. 133736.

System and method for mitigating errors occurring in data processing units implemented with digital circuits, O. Amaricai-Boncalo, A. Amaricai-Boncalo Zs. Lendek, patent no. 134587.

Corecția suprafețelor plane din imaginile provenite de la camere cu informație de distanță folosind rețele neuronale convoluționale, Marian Pop, Levente Tamas, patent no. A2021_00559

Metoda pentru estimarea normalelor pentru camere cu informație de distanță emițătoare de impulsuri, folosind rețele neuronale convoluționale, Szilard Molnar, Levente Tamas, patent no. A2021_00560

Offer to industry

Research & development	Signal processing Control algorithms Monitoring and estimation Artificial intelligence and machine learning Mobile robotics and robotic manipulation Advanced system control and monitoring Embedded software design
Consulting	Control system design and development Monitoring system design and development Robotic system design & engineering 2D and 3D mapping and surveys
Applied engineering services	Process and control engineering Robotics related services Process equipment related services
Training	Control and monitoring System identification Optimization and optimal control Computer integrated manufacturing Process equipment Industrial robotics Mobile vehicles

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