ELECTROMECHANICAL SYSTEMS RESEARCH CENTER

Contact details

Name	**Electromechanical Systems Research Center**
Acronym	**EMS**
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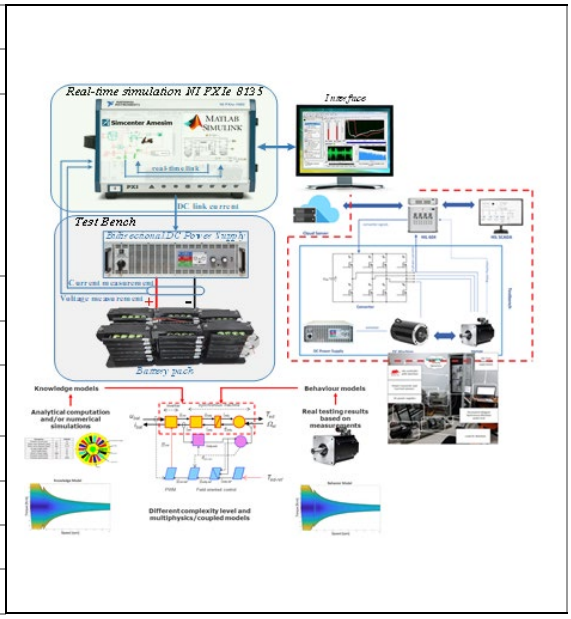

Areas of expertise

The center offers multidisciplinary R&D capabilities in the following fields:

- AI-enabled electromechanical drive and actuation systems
- Smart industrial systems and digital transformation
- Battery technologies: modeling, testing, and control
- Intelligent systems for renewable energy and smart grids
- Power electronics and electrification technologies
- Advanced control systems and embedded intelligence
- Condition monitoring, diagnostics, and predictive maintenance

Team

Researchers: Prof. Claudia Steluta Marțiș, PhD; Assoc. Prof. Florin Nicolae Jurca, PhD; Assoc Prof. Claudiu Alexandru Oprea, PhD; Assoc. Prof. Mircea Ruba, PhD; Lecturer Adrian Augustin Pop, PhD; Lecturer Sorin Iulian Cosman, PhD; Lecturer Răzvan Alexandru Inte, PhD.

PhD students: Cristina Adăscăliței, Konstantinos Ntontis, Raymond Birasa, Bogdan Butnariu, Doha Kamal, Sebastian Ciceo, Cristian Dobos, Auruta Buta, Ludmila (Lutencu) Zavgorodnii, Claudiu Cotovanu, Danut Popa, Cosmin Negru, Mihai Coseriu, Teodor-Sebastian Ursache, Paula-Ioana Șerban.

Ongoing projects

DiTArtIS – Network of excellence in digital technologies and AI solutions for electromechanical and power systems applications (HORIZON-WIDERA-2021-ACCESS-03-01), 2022-2025. Director: Prof. Claudia Marțiș. https://ditartis.utcluj.ro/
MAXIMA – Modular AXIal flux Motor for A utomotive – MAXIMA (HORIZON-CL5-2022-D5-01, partner, 2023-2027. Director: Prof. Claudia Marțiș. https://maxima-he.eu
Studiul tehnic pentru dezvoltarea unui sistem de stocare a energiei electrice cu baterii tip LiFePo (ROMBAT S.A.), 2022-2027. Director: Conf.dr.ing. Mircea Ruba.
Studiu metodologic privind potentialul de dezvoltare a microretelelor si integrarea energiei regenerabile in Africa de Nord. [*MiDiNA*], UEFISCDI: PN4P8-300/26.04.2024, 2024-2026. Director: s.l. dr.ing. Adrian Augustin Pop, https://ems.utcluj.ro/midina.html

Significant results

The most representative publications of the past 5 years:

[1] Ruiz-Sarrio, J.E., Antonino-Daviu, J.A., Martiș, C., Llovera-Segovia, P. and Fuster-Roig, V., **Influence of Rotor Position in the Broadband Impedance Response for SFRA Rotating Machine Diagnosis**. IEEE Transactions on Industry Applications,vol. 60, no. 4, pp. 6133-6143, 2024.

[2] Adăscăliței, C., Martiș, R.A., Karaisas, P. and Martiș, C.S., **In-Depth Exploration of Design and Analysis for PM-Assisted Synchronous Reluctance Machines: Implications for Light Electric Vehicles**. Machines,

vol. 12, no. 6, paper #361, 2024.
[3] Ruiz-Sarrio, J.E., Antonino-Daviu, J.A. and Martis, C., **Localized Bearing Fault Analysis for Different Induction Machine Start-Up Modes via Vibration Time–Frequency Envelope Spectrum**. Sensors, vol. 24, no. 21, paper #6935, 2024.
[4] Nemeş, R.O., Ruba, M., Raia, M.R., Martiş, C. and Oprea, C.A., **X-in the Loop based high accuracy test facility for industrial development of electric vehicles**. IEEE Transactions on Transportation Electrification, vol. 9, no. 2, pp. 2778-2791, 2023.
[5] Maria Raluca Raia, Sebastian Ciceo, Fabien Chauvicourt, Claudia Martis, **Multi-Attribute Machine Learning Model for Electrical Motors Performance Prediction**, Applied Sciences, **2023**, *13*(3), 1395;https://doi.org/10.3390/app13031395
[6] Ciceo, S., Chauvicourt, F., Gyselinck, J. and Martis, C., 2022., **Data-driven electrical machines structural model using the vibration synthesis method**, IEEE Transactions on Transportation Electrification, vol. 8, no. 3, pp. 3771-3781.
[7] Ruiz-Sarrio, J.E., Chauvicourt, F., Gyselinck, J. and Martis, C., **Impedance Modeling Oriented Toward the Early Prediction of High-Frequency Response for Permanent Magnet Synchronous Machines**, IEEE Transactions on Industrial Electronics, vol. 70, no. 5, pp. 4548-4557, 2022.
[8] Pop, A.A., **Incremental Encoder Speed Acquisition Using an STM32 Microcontroller and NI ELVIS**. Sensors, vol. 22, no. 14, paper #5127, 2022.

Significant solutions:
Energy-efficient actuation systems for industrial applications, AI-based optimization of electromechanical systems, DT for advanced drive systems, Battery modeling and state estimation algorithms, Intelligent battery management systems (BMS), Performance testing and characterization platforms, State-of-charge and state-of-health estimation methods, Thermal management and lifetime optimization, Control strategies for hybrid energy storage systems, Smart control systems for photovoltaic, Energy management systems for microgrids, Grid integration solutions for distributed generation, Electric propulsion systems, Energy management solutions for electric vehicles, Simulation and testing platforms for e-mobility applications, Integrated solutions for vehicle electrification, Prototypes and demonstrators.

Products and technologies:
Integrated solutions for vehicle electrification, Prototypes and demonstrators.

The offer addressed to the economic environment

The **Electromechanical Systems Research Center (EMS)** provides advanced research and development services dedicated to innovative, sustainable, and intelligent solutions for industry, energy systems, and electric mobility. Building upon strong scientific expertise and modern laboratory infrastructure, the center supports partners throughout the entire innovation lifecycle – from concept definition to technology validation and implementation.

Research & development	Applied Research and Innovation Development • Concept development and feasibility studies • Design of intelligent electromechanical systems • Modeling and simulation of complex electromechanical processes • System integration for industrial and energy applications • Proof-of-concept development and experimental validation Product and Technology Development • Design and prototyping of advanced actuation and drive systems • Design of battery management systems (BMS) • Optimization of electric propulsion systems for e-mobility • Hardware-in-the-loop (HIL) and model-in-the-loop (MIL) testing Testing, Evaluation, and Validation • Performance testing of electromechanical systems • Experimental characterization of electric drives and power electronics • Battery testing, modeling, and lifetime estimation Digitalization and Smart Systems Services • Development of intelligent monitoring and diagnostics systems • Implementation of predictive maintenance solutions • Digital twin development for electromechanical systems • Integration of smart sensors and IoT technologies
Consulting	• Technical consultancy for electrification projects • Technology assessment and benchmarking • Custom R&D solutions for industrial partners • Support for innovation roadmaps and technology strategies • Support in the preparation of joint research projects
Training	Training programs and knowledge transfer in all the fields of expertise of the Center.

January 2026