


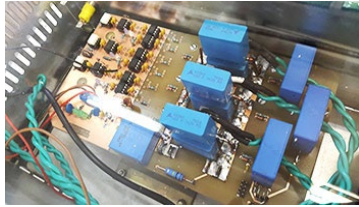


CENTER OF APPLIED RESEARCHES IN ELECTRICAL ENGINEERING FOR SUSTAINABLE DEVELOPMENT

Contact details

Name	Center of Applied Researches in Electrical Engineering for Sustainable Development	Hardware-in-the-loop (HiL) battery test bench	
Acronym	CCAIEDD		
Logo		Permanent magnet synchronous machine of 20 kW and 26,000 r/min	
Site	http://memm.utcluj.ro/ccaiedd/en/index.html		
Address	2 Observatorului str., 400489 Cluj-Napoca, Romania	150 V and 200 A power converter	
Faculty Department	Faculty of Electrical Engineering Electrical Machines and Drives Department		
Telephone	+40 264 401827		
Fax	+40 264 593117		
Director	Prof. Dr. Eng. Loránd Szabó		
e-mail	Lorand.Szabo@emd.utcluj.ro		

Areas of expertise

Design, modeling, and optimization of electrical machines and drives for energy-efficient applications in industrial, automotive, and renewable-energy sectors
Control of electrical and electromechanical systems
Condition monitoring, fault tolerance, and diagnostics of electromechanical systems
DSP, microcontroller, and FPGA programming
Hardware-in-the-Loop (HiL) simulation for hybrid-electric vehicles
Sustainable development strategies in modern electrical engineering

Team

Prof. Dr. Loránd Szabó, Prof. Dr. Horia Hedeşiu, Prof. Dr. Csaba Szász, Prof. Dr. Daniel Fodorean, Prof. Dr. Ştefan Breban, Assoc. Prof. Dr. Dan-Cristian Popa, Assoc. Prof. Dr. Florin Jurca, Assoc. Prof. Dr. Mircea Ruba, Assoc. Prof. Dr. Claudiu Oprea, Lecturer Dr. Adrian Augustin Pop, Lecturer Dr. Sorin Iulian Cosman, Lecturer Răzvan Alexandru Inţe, Researchers: Claudia Violeta Pop, Ph.D. students: Simina Derban, Erzsébet Mátyás, Teodor-Sebastian Ursache, Paula-Ioana Şerban, Eliza-Maria Olariu, Diana Artudean, Norbert Kertész, Sára Ferenci, Florina-Ambrozia Coteţ.

Representative projects

Romanian Hydrogen and New Energy Technologies Hub, 2025-2029. Coordinator TUCN: Prof.dr. Daniel Fodorean.
Innovative Multi-Life Battery Management System for Future Energy Storage Solutions, Project manager: Assoc.prof.dr. Mircea Ruba.

Significant results

The most representative publications of the past years:

- [1] Fodorean, D., 2026. **High-Speed Electric Motors for Fuel Cell Compressor System Used for EV Application—Review and Perspectives**. Applied Sciences, 16(1), p.476.
- [2] Coteţ, F.A., Ferenci, S., Lakatos, E.S. and Szabó, L., 2026. **The AI-Driven Hydrogen Community: A Critical Review of Design Strategies for Decentralized Integrated Energy Systems**. Designs, 10(1), p.12.
- [3] Ferenci, S., Coteţ, F.A., Lakatos, E.S., Munteanu, R.A. and Szabó, L., 2026. **Artificial intelligence in local energy systems: A perspective on emerging trends and sustainable innovation**. Energies, 19(2), p.476.
- [4] Szabó, G.S., Coteţ, F.A., Ferenci, S. and Szabó, L., 2026. **Advances in Materials and Manufacturing for Scalable and Decentralized Green Hydrogen Production Systems**. Journal of Manufacturing and Materials Processing, 10(1), p.28.
- [5] Popa, D.C. and Szabó, L., 2025. **Overcoming Catch-22 for rare earth metals in green transition: Solutions in electrical machine manufacturing**. Renewable and Sustainable Energy Reviews, 207, p.114917.
- [6] Rhazzali, A.L., Lakatos, E.S., Minea, G., Cioca, L.I., Barnisca, M., Ferenci, S., Szabó, L. and Munteanu, R.A., 2025.

- Measuring Circular Economy Indicator in Hydropower Refurbishment.** Energies, 18(22), p.5922.
- [7] Szabó, L., 2025. **Deep-Sea Mining and the Sustainability Paradox: Pathways to Balance Critical Material Demands and Ocean Conservation.** Sustainability, 17(14), p.6580.
- [8] Sanislav, T., Mois, G.D., Zeadally, S., Folea, S. and Hedesiu, H., 2024. **A Smart Platform for Monitoring and Managing Energy Harvesting in Household Systems.** Energies, 17(23), p.5977.
- [9] Fodorean, D., 2024. **Technological Trends for Electrical Machines and Drives Used in Small Wind Power Plants—A Review.** Energies, 17(24), p.6483.
- [10] Popa, D.C. and Szabó, L., 2024. **Securing rare earth permanent magnet needs for sustainable energy initiatives.** Materials, 17(22), p.5442.

Significant solutions:

Prototypes and laboratory models of special electrical machines; static converters; fault detection and fault tolerant systems; electrical machines MiL and HiL testing and evaluation procedures, solar electric vehicle for solar car student competition, etc.

Products and technologies:

Microcontroller-based boards for motor control, energy management, and position detection based on resolvers, DSP development boards for motor control and diverse applications, FPGA-based development boards for motor control and diverse applications, energy management: on board on light electric vehicles and hybrid power sources, HiL testing platforms for electric vehicle propulsion, and auxiliary systems.

Patents:

- [1] Ș Breban, M. Dranca, I. Mălăel: **Airborne wind power generation system**, no. RO133886.
- [2] Ș Breban, M. Dranca, M. Fărtan, **Electric propulsion machine with direct drive wheel for guided track transport vehicles**, no. RO134496.

The offer addressed to the economic environment

Research & development	Electrical machine design and optimization Electrical drives and control based on microcontrollers, DSPs, and FPGA devices Electromechanical systems for smart, green, and integrated transportation Secure, clean, and efficient renewable energy generation and storage systems Energy management on hybrid electrical power sources Offering advanced technical solutions for industrial clients in all our research fields. Seeking research & development partners (both from industry and academia) in all the fields of expertise of the center.
Consulting	Offering consultancy services for companies in all the fields of expertise of the center. Offering applied engineering services for companies in all our fields of expertise.
Training	Offering training for under and postgraduate students, Ph.D. students, and engineers working in research and industry in all the fields of expertise of the Center.

Last updated February 2026