

ADMISSION TO DOCTORAL STUDIES

Session September 2025

Field of doctoral studies: electrical engineering

Doctoral supervisor: Prof. Ioan Serban

TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

TOPIC 1: *AI-enhanced control for microgrids with renewable energy sources*

Contents / Main aspects to be considered :

- microgrid hardware configuration analysis;
- control of parallel inverters in a microgrid;
- implementation of advanced control based on AI techniques ;
- modelling and simulation of the microgrid (hardware and control);
- experimental model development in laboratory;
- experimental validation.

Recommended bibliography:

- [1] N. Hatziargyriou, Microgrids – Architectures and Control, IEEE Press-Wiley, 2014;
- [2] I. Serban, S. Céspedes, C. Marinescu, C. A. Azurdia-Meza, J. S. Gómez and D. S. Hueichapan, "Communication Requirements in Microgrids: A Practical Survey," in IEEE Access, vol. 8, pp. 47694-47712, 2020.
- [3] E. Mohammadi, M. Alizadeh, M. Asgarimoghaddam, X. Wang and M. G. Simões, "A Review on Application of Artificial Intelligence Techniques in Microgrids," in IEEE Journal of Emerging and Selected Topics in Industrial Electronics, vol. 3, no. 4, pp. 878-890, Oct. 2022.
- [4] S. Zhao, F. Blaabjerg and H. Wang, "An Overview of Artificial Intelligence Applications for Power Electronics," in IEEE Transactions on Power Electronics, vol. 36, no. 4, pp. 4633-4658, April 2021.
- [5] D. B. Rathnayake et al., "Grid Forming Inverter Modeling, Control, and Applications," in IEEE Access, vol. 9, pp. 114781-114807, 2021, doi: 10.1109/ACCESS.2021.3104617.

Prerequisites / Remarks:

- Bachelor's degree and/or master's degree in electrical engineering or in a similar domain;
- Good command of English ;
- Programming knowledge (e.g. Python, Matlab)

☒ **Scientific Doctorate (full-time only)**

☐ **Professional Doctorate (full-time or part-time)**

☐ **without tuition fee (state budget funded)**

☒ **with tuition fee or with funding from other sources than the state budget**

TOPIC 2: *Software for optimal management of energy resources in smart cities, integrating microgrids based on renewable energy sources and electric vehicle charging capabilities.*

Contents / Main aspects to be considered

- key challenges and limitations in the state of the art of smart microgrids (MGs) with electric vehicle (EV) charging capabilities;
- Research and analysis of existing software and technologies that can support the management and operation of smart MGs with EV charging capabilities in the context of Smart Cities;
- Use of a 24/48-hour forecast for renewable energy sources (RES);
- Development of a database of charging stations (CS), based on RES, with information on geographic location, availability, and charging schedules, and other conventional CSs;
- Implementation of an online payment facility using blockchain technology;
- Redistribution of EV charging based on grid load, to avoid grid overloading;
- Redistribution of EV charging based on CS congestion.

Recommended bibliography:

- [1] N. Hatziaargyriou, Microgrids: Architectures and Control. John Wiley & Sons Ltd., 2014, p. 4, ISBN 978-1-118-72068-4.
- [2] I. Serban, S. Cespedes, C. Marinescu, et al., "Communication Requirements in Microgrids: A Practical Survey," IEEE Access, 2020, DOI: 10.1109/ACCESS.
- [3] C. Marinescu, "Design Considerations Regarding a Residential Renewable-Based Microgrid with EV Charging Station Capabilities," Energies, vol. 14, no. 16, p. 5085, 2021.
- [4] C. Marinescu, "Progress in the Development and Implementation of Residential EV Charging Stations Based on Renewable Energy Sources," Energies, vol. 16, no. 1, p. 179, 2023.
- [5] Congress of Smart Cities – Proceedings ICSC-CITIES 2022. Disponibil online, <https://icsc-cities.com/proceedings/2022.pdf>
- [6] D. Bakken (Ed.), Smart Grids: Clouds, Communications, Open Source, and Automation. CRC Press, 2014.

Prerequisites / Remarks:

- Bachelor's degree and/or master's degree in electrical engineering or in a similar domain;
- Good command of English ;
- Good programming skills.

☒ **Scientific Doctorate (full-time only)**

☐ **Professional Doctorate (full-time or part-time)**

☒ **without tuition fee (state budget funded)**

☐ **with tuition fee or with funding from other sources than the state budget**

Doctoral supervisor,

Coordinator of the field of doctoral studies,

Prof. Ioan Serban

Prof. Ioan Serban

Signature

Signature