



## ADMISSION TO DOCTORAL STUDIES

Session September 2026

**Field of doctoral studies: Electrical Engineering**

**Doctoral supervisor: Assoc. Prof. Dr. Marius VOLMER**

### TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

**TOPIC 1:** *Studies on the use of spintronic magnetoresistive sensors for magnetic field detection and non-contact monitoring of electrical components*

**Contents / Main aspects to be considered** - The detection of extremely low magnetic fields, with resolutions on the order of nT, is limited by the electrical noise of the MR sensor. Studies will be conducted regarding the appropriate selection of the MR sensor with linearity ranges, sensitivity, and noise levels suitable for the proposed applications. Strategies for reducing the electrical and magnetic noise of the sensor, as well as signal processing techniques to decrease the 1/f noise level, will be studied. High-performance architectures for non-contact current detection, both hardware and software thermal compensation methods, techniques for expanding the dynamic measurement range, and advanced signal conditioning and acquisition systems based on emerging technologies such as Machine Learning, Artificial Intelligence, and other advanced data processing algorithms will be proposed. Studies will be carried out regarding the non-contact monitoring of critical components in electrical equipment and the real-time estimation of their condition based on signal analysis.

**Recommended bibliography:**

1. Amir Elzawwy et al. (2024). Magnetic Sensors: Principles, Methodologies, and Applications. In: Ali, G.A.M., Chong, K.F., Makhoulouf, A.S.H. (eds) Handbook of Nanosensors. Springer, Cham.  
[https://doi.org/10.1007/978-3-031-16338-8\\_33-1](https://doi.org/10.1007/978-3-031-16338-8_33-1)
2. Amir Elzawwy et al. Current trends in planar Hall effect sensors: evolution, optimization, and applications, J. Phys. D: Appl. Phys. 54 353002 (2021), <https://doi.org/10.1088/1361-6463/abfbfb>
3. Alberto Nicolicea et al. Flexible anisotropic magnetoresistive sensors for novel magnetic flux leakage testing capabilities, NDT & E International, Volume 146, 2024, 103160, ISSN 0963-8695, <https://doi.org/10.1016/j.ndteint.2024.103160>
4. C. Muşuroi et al. High sensitivity differential GMR based sensor for non-contacting DC/AC current measurement, Sensors, 20(1), 323 (2020); <https://doi.org/10.3390/s20010323>
5. C. Muşuroi et al. Low Field Optimization of a Non-Contacting High-Sensitivity GMR-Based DC/AC Current Sensor. Sensors, 21(7), 2564 (2021), <https://doi.org/10.3390/s21072564>

**Prerequisites / Remarks:** *Bachelor's and Master's studies on electrical engineering or closed related fields.*

**Scientific Doctorate**

**Professional Doctorate**

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

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

**Doctoral supervisor,**

Assoc. Prof. Dr. Marius VOLMER

Signature

**Coordinator of the field of doctoral studies,**

Prof. Dr. Ioan ȘERBAN

Signature