



Name of the course: **Modelling and experimental study of electric drives**

Course type: Optional

Responsible lecturer: Dr. Gusztáv Áron Sziki

Content: The course deals with the detailed theoretical and experimental study of an alternating current (AC) and a direct current (DC) motor. The AC motor is a 3-phase induction motor (IM), while the DC one is a series-wound DC (SWDC) motor. The theoretical study of the IM includes the modelling of the motor in phase coordinates, the voltage and torque equations, the consideration of space harmonics, and the modelling of the motor based on space vector representation. Regarding the SWDC motor both magnetically linear and non-linear models are described, presenting the voltage and torque equations. In the case of the linear model the self and mutual inductances are constants, while in the case of the non-linear model, they depend on the current intensity and are defined as the partial derivatives of the corresponding magnetic fluxes with respect to the current intensity. Finally, all the models are implemented in MATLAB/Simulink environment.

The experimental study, on the one hand, includes the measurement of the electromagnetic and dynamic characteristics of the motors, which serve as the input data of the simulation programs, and on the other hand, test measurements. During the test measurements, voltage is switched on the motor, and its torque, angular speed and the intensity of electric current, flowing through it, are measured as a function of time. After that, the simulation is performed with the same input data. By comparing the simulation and test results, we gain information on the accuracy of the simulation, and indirectly, on the exactness of the model. The experiments are performed on the measurement system designed and implemented at the Faculty of Engineering of the University of Debrecen. The course provides a unique opportunity to the PhD students to apply their knowledge in Physics, Computer Science and Metrology combined for the investigation of electric motors.

Literature:

- Mohan, N. (2014). *Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB/Simulink*. Wiley Blackwell. <https://doi.org/10.1002/9781118910962>
- Wach, P. (2011). *Dynamics and Control of Electrical Drives*. doi:10.1007/978-3-642-20222-3
- Dr. Retter Gyula, *Az egységes villamosgépelmélet*, Műszaki Könyvkiadó, Budapest, 1976.
- Sziki, Gusztáv Áron; Sarvajcz, Kornél; Kiss, János; Gál, Tibor; Szántó, Attila; Gábora, András; Husi, Géza: *Experimental investigation of a series-wound dc motor for modeling purpose in electric vehicles and mechatronics systems*, MEASUREMENT 109 pp. 111-118, 8 p. (2017)