Study program: Electrical and Computing Engineering – Module: Industrial Power Engineering

Type and level of studies: Doctoral Academic Studies (third degree academic studies)

Course unit: Digital Control of Power Converters and Drives

Course lecturer: Marko M. Rosić

Language of instruction: English

ECTS: 6

Prerequisites: Passed exams: Electrical machines, Electric drives, Power Electronics

Semester: Winter

Course unit objective

The course provides an additional knowledge in the field of modern control techniques of electric drives and power converters implemented in digital based control systems.

Learning outcomes of Course unit

Students will be able to design and implement advanced control algorithms of AC and DC electric machines and deal with actual problems in the field.

Course unit contents

Theoretical classes

Dynamic characteristic of DC and AC machines and corresponding mathematical models. Configuration of modern power converters. Method of pulse width modulation and voltage generation. A/D conversion, current and voltage measurement, speed signal processing. Digital signal processors and their role in electric drives. Modeling of power converters and electrical machines. *Matlab/Simulink/DSP toolbox.* Implementation scalar and vector control methods (conventional and modified control methods U/f, FOC based on rotor and stator flux, DTC with discrete and continual voltage vectors). Estimation of electrical and non-electrical quantities in electric drives. Sensorless control method.

Practical classes

Practical work in laboratory environment. Implementation and evaluation of various control techniques at modern digital platforms.

Literature:

[1] S.Vukosavic, *Digital control of electrical drives*, Springer US, 2007.
[2] P. Vas, *Sensorless Vector and Direct Torque Control*, Oxford University Press, 1998.
[3] B. Bose, *Modern Power Electronics and AC Drives*. Prentice-Hall, Inc., 2002.
[4] P. C. Krause, O. Wasynczuk, and S. D. Sudhoff, *Analysis of Electric Machinery and Drive Systems*. IEEE, 2002.
[5] B. Bose, *Power electronics and motor drives - advances and trends*. Elsevier Inc.,2006.
[6] Boldea, I. Nasar, S. A., *Electric drives*, Taylor&Francis Group, 2006.
[7] El-Hawary E. M., *Principles of electric machines with power electronic applications*, The Institute of Electrical and Electronics Engineers, 2002.
[8] Mohan N., *ADVANCED ELECTRIC DRIVES analysis, control and modelling using SIMULINK*, MNPERE, 2001.

Number of active teaching hours				**Other classes**
Lectures: 2	*Practice: 2*	*Other forms of classes:* 0	*Independent work:* Case study	

Teaching methods: ex cathedra classes, consultations, independent individual home and laboratory work

Examination methods (maximum 100 points)

Exam prerequisites	**No. of points:**	**Final exam**	**No. of points:**
Student's activity during lectures	**5**	oral examination	**30**
Practical classes	**10**	written examination	**30**
Seminars/homework	**10**	.....	
Project	**15**		

Grading system

Grade	**No. of points**	**Description**
10	**91-100**	Excellent
9	**81-90**	Exceptionally good
8	**71-80**	Very good
7	**61-70**	Good
6	**51-60**	Passing grade
5	**less than 50**	Failing grade