COURSE DESCRIPTION CARD - SYLLABUS

Course name

Automation of electric propulsion systems

Course

Field of study	Year/Semester
Electrical Engineering	2/3
Area of study (specialization)	Profile of study
Drive Systems in Industry and Electromobility	general academic
Level of study	Course offered in
Second-cycle studies	Polish
Form of study	Requirements
full-time	elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
	15	
Tutorials	Projects/seminars	

Number of credit points

1

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Basic knowledge about electrical and magnetic circuits. The knowledge of the principles of electrical machines.

Differential and integral calculus on the basic level.

Ability of the effective self-education in the field associated with chosen subject; the ability to make appropriate decisions in solving tasks and formulating problems in the design of electrical drive systems, as well as the ability to program in selected high-level language.

The student is aware of a need to expand its competence, readiness to undertake the cooperation in the team.

Course objective

To learn about modern industrial electric drive control systems. Gain practical skills in selecting and parametrizing inverters in drive systems as well as programming industrial servo drives.

Course-related learning outcomes

Knowledge

1. Has in-depth and expanded knowledge of physics, necessary to understand the physical phenomena affecting the properties of new materials and the operation of advanced electrical systems.

2. Has knowledge of development trends, new developments and dilemmas of modern engineering.

3. Has general knowledge of propulsion systems and their design, and detailed knowledge in the application of identification principles and the use of computer simulation software in this field.

Skills

1. Is able formulate and test hypotheses related to engineering problems and simple research problems, develop detailed documentation of the results of the experiment, design task.

2. Is able to plan the process of testing complex electrical equipment and systems.

2. Is able to evaluate and compare design solutions and manufacturing processes of electrical components and systems, in view of given utility and economic criteria such as electrical parameters, reliability, time consumption, cost, etc.

Social competences

Recognizes the importance of knowledge in solving cognitive and practical problems, and understands that in technology, knowledge and skills quickly become obsolete, and therefore require constant replenishment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory exercises:

- testing and bonus of knowledge necessary to implement the set problems in a given area of laboratory tasks,

- continuous assessment, at each class - rewarding the increment of skills in the use of learned principles and methods,

- evaluation of knowledge and skills related to the implementation of the exercise task, evaluation of the report on the completed exercise.

Obtaining additional points for activity during classes, especially for:

- proposing to discuss additional aspects of the issue,

- ability to cooperate as part of a team practically implementing a detailed task in the laboratoryy

Programme content

Laboratory exercises:

Systems and test stands for configuration, parameterization and testing of industrial servo drives. Systems and test stands for configuration, parameterization and testing of drive inverters. Industrial servo drives, construction, principle of operation and control methods. Actuators with linear and rotary motion, construction, principle of operation. Feedback systems, industrial incremental and absolute position transducers, communication interfaces. Angular position transformers (resolvers), construction, principle of operation. Controllers of servo drives, construction, structure of the control system. Tuning of regulator parameters. Operating modes of industrial servo drive, state machine according to PLCopen Motion Control. Group operation of industrial servo drives in synchronization mode. Industrial inverters in electric drive, parameterization, configuration and control algorithms.

Teaching methods

Laboratories:

- multimedia presentation of instructions for performing exercises

- detailed review of reports by the instructor, discussion,

- demonstrations,

- work in teams.

Bibliography

Basic

1. Hakan Gurocak, Industrial Motion Control: Motor Selection, Drives, Controller Tuning, Applications, Wiley, ISBN: 978-1-118-40314-3 March 2016.

2. Radosław Krzyżanowski, SIMATIC Motion Control - sterowanie serwonapędami. Teoria. Aplikacje. Ćwiczenia, Wydawnictwo: Helion S.A., 2021, ISBN: 978-83-283-7592-5.

3. Sünder, Christoph & Zoitl, Alois & Mehofer, F. & Favre-Bulle, B.. (2006). Advanced use of PLCopen motion control library for autonomous servo drives in IEC 61499 based automation and control systems. e & i Elektrotechnik und Informationstechnik. 123. 191-196. 10.1007/s00502-006-0341.

4. Terry M. L. Bartelt, Industrial Automated Systems: Instrumentation and Motion Control, ISBN 13: 9781111321901, Publisher: Cengage Learning, 2011.

Additional

1. Bezczujnikowe układy napędowe z silnikami indukcyjnymi, Orłowska-Kowalska T., Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003.

2. Dokumentacja bibliotek PLCopen Motion Control, dokumentacja techniczna napędów Acopos oraz Lenze 9400

3. Torque Ripple Minimization of the Permanent Magnet Synchronous Machine by Modulation of the Phase Currents, Jędryczka C, Danielczyk D, Szeląg W., Sensors. 2020; 20(8):2406. https://doi.org/10.3390/s20082406.

4. Finite element analysis and experimental verification of high reliability synchronous reluctance machine, Łyskawiński W., Jędryczka C., Dorota Stachowiak D., Łukaszewicz P., Czarnecki M., Maintenance and Reliability 2022, vol. 24, no. 2, s. 386-393.

Breakdown of average student's workload

	Hours	ECTS
Total workload	30	1,0
Classes requiring direct contact with the teacher	15	0,5
Student's own work (literature studies, preparation for laboratory classes) [1]	15	0,5

[1] delete or add other activities as appropriate