COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrical drives in industrial applications [N2AiR1-ISAiR>NEwAP]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/2

Area of study (specialization)
Intelligent Control and Robotic Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
10

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr hab. inż. Tomasz Pajchrowski
tomasz.pajchrowski@put.poznan.pl

Lecturers

dr hab. inż. Tomasz Pajchrowski
tomasz.pajchrowski@put.poznan.pl

dr inż. Bartłomiej Wicher
bartlomiej.wicher@put.poznan.pl

Prerequisites

The student must have engineering competences (i.e. the professional title of engineer) and qualifications, i.e. knowledge, skills and competences defined in the field learning outcomes according to the Polish Qualification Framework (PRK 6) for the degree programme in the field of automatics and robotics at the Poznan University of Technology, with particular emphasis on the learning outcomes of the first degree programme in this field.

Course objective

Learning about the construction, principle of operation and methods and structures of typical and advanced control systems of electric drives supplied from converter systems used in processes, machines, devices and robots.

Course-related learning outcomes

Knowledge

[K2_W6] has detailed knowledge of the construction and use of advanced sensory systems;
[K2_W10] has structured and deepened knowledge within selected areas of robotics;
[K2_W11] has structured and deepened knowledge related to control systems and control and measurement systems;
Skills
[K2_U10]can determine models of simple systems and processes, and use them for the analysis and design of automation and robotics systems;
[K2_U12]is able to integrate and program specialised robotic systems;
Social competences
[K2_K4]is aware of the need for a professional approach to technical issues, scrupulous familiarisation with the documentation and the environmental conditions in which the equipment and its components may operate;

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: the exam consists of a test in the form of a written response to a given question and a discussion (optional) on selected issue(s) with the explanation of written answers from the scope of the curriculum content.
Laboratory exercises: attendance at classes and performing laboratory exercises in groups and submitting written reports.

Programme content

Lecture:
1. general structure of automated drive system 2. simple speed control systems in household appliances (DC drive - speed control methods) 3. automated DC transistor and thyristor drive . 4 Drives used in drones, electric vehicles (Brushless DC Motor Drive (BLDC), ACIM - Induction Motor Drive) 5. Drives used in robots (PMSM) 6. Control of drive systems with complex and variable dynamic structure (variable moment of inertia, elasticity in two-mass and multi-mass systems). Electric drives in vehicles (cars, buses, railways, autonomous vehicles), (so-called electromobility, specific control of electric drives in vehicles) 8. SynRM and reluctance motor drive 9. Electric drives used in space (inertial drives)Laboratory exercises. The plan of the laboratory assumes getting acquainted with the practical aspect of modelling selected issues of energy-saving building control or electric vehicle verification of the experimental convergence of the developed mathematical model (with independent identification of parameters) in order to make students aware of good practices of research methodology and acquire the belief that the presented theory has a direct impact on practice.
Laboratory exercises. The programme of laboratory exercises includes familiarisation with the design, software, commissioning and testing of static and dynamic properties of selected physical drive systems.

Teaching methods

Lecture
Lecture with multimedia presentation (including: drawings, photos, animations, sound, films) supplemented by examples given on the board. Initiating discussion during the lecture.
Laboratory.
Working in teams and team programming, carrying out tasks given by the teacher - practical exercises.

Bibliography

Basic
1. Zawirski K., Deskur J., Kaczmarek T., Automatyka napędu elektrycznego, Wydawnictwo Politechniki Poznańskiej, Poznań, 2012.
2. Kaczmarek T. , Napęd elektryczny robotów, Wydawnictwo Politechniki Poznańskiej, Poznań, 1998
3. Kaźmierkowski M.P, Tunia H., Automatic Control of Converter-Fed Drives, ELSEVIER, Amstertdam, London, New York, Tokyo, Warszawa , 1994
4. Zawirski K., Deskur J., Kaczmarek T., Automatyka napędu elektrycznego, Wydawnictwo Politechniki

Poznańskiej, Poznań, 2012.
5. Lech Grzesiak L., Kaszewski A., Ufnalski B.: Sterowanie napędów elektrycznych. Analiza, modelowanie, projektowanie. Wydawnictwo Naukowe PWN, Warszawa 2016.
6. Sieklucki G., Bisztyga B., Zdrojewski A., Orzechowski T., Sykulski R.: Modele i zasady sterowania napedami elektrycznymi, Wydawnictwo AGH, Kraków 2014
Additional
1. Leonhard W., Control of Electrical Drives, Springer, Berlin, New York, 2001
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5. Deskur J., Pajchrowski T., Zawirski K.: ?Speed Controller for a Drive With Complex Mechanical Structure And Variable Parameters?, Proceedings of 16th International Power Electronics and Motion Control Conference and Exposition, PEMC?2014, 21-24 September 2014, Antalya/Turkey, CD.
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7. Zawirski K., Janiszewski D., Muszyński R.: Unscented and Extended Kalman filters study for Sensorless Control of PM Synchronous Motors with Load Torque Estimation, Bulletin of Polish Academy of Sciences ? Technical Sciences, vol. 61, No. 4, 2013
8. Fabiański B., Zawirski K.: Simplified model of Switched Reluctance Motor for real-time calculations, Przegląd Elektrotechniczny, ISSN 0033-2097, R. 92 NR 7/2016
9. Nowopolski K., Wicher B., Zawirski K.: Experimental Analysis of Selected Control Algorithms of Electromechanical Object with Backlash and Elastic Joint, IEEE 17th International Conference on Power Electronics and Motion Control, Varna, Bulgaria, 25 ? 30 of September 2016
10. Szczesniak P., Urbanski K., Fedyczak Z., Zawirski K.: Comparative study of drive systems using vector-controlled PMSM fed by a matrix converter and a conventional frequency converter, TURKISH JOURNAL OF ELECTRICAL ENGINEERING & COMPUTER SCIENCES, vol. 24, pp. 1516?1531, 2016

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50