GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Electric Drives (WEiA), PG_00042095 | | |
| Field of study | Power Engineering, Power Engineering | | |
| Date of commencement of studies | October 2022 | Academic year of realisation of subject | 2024/2025 |
| Education level | first-cycle studies | Subject group | |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 3 | Language of instruction | English |
| Semester of study | 6 | ECTS credits | 4.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Department of Controlled Electric Drives -> Faculty of Electrical and Control Engineering | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Jarosław Guziński | |
| | Teachers | | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 0.0 | 0.0 | 0.0 | 15.0 | 30 |

E-learning hours included: 0.0

**Learning activity and number of study hours**

| Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM |
|---|---|---|---|---|
| Number of study hours | 30 | 5.0 | 65.0 | 100 |

**Subject objectives**

Get basic knowedge and skill on electrical drives

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_W05] has structured knowledge in the field of electrical engineering and electronics, necessary to understand the basics of operation and selection of electrical machines, electricity transmission systems and power electronic devices | Student defines work regimes of electrical machines, distinguishes kinds of load, defines machine loads, explains equations of machine dynamics, principles of motion control, determines machine models, defines structures of drive systems with AC and DC machines, explains principles of energy recovery, explains basic principles of vector control. | [SW1] Assessment of factual knowledge |
| [K6_U01] can obtain information from literature and other sources, organize, interpret it and draw and formulate conclusions; has the ability to self-educate, interprets the results of completed engineering tasks, is able to design simple energy systems and their systems | Is able to obtain information that allows calculation and design of the drive system for selected types of load mechanisms. | [SU2] Assessment of ability to analyse information |
| [K6_K03] is able to react in emergency situations, threats to health and life when using energy devices, is aware of the impact of engineering activities on the environment | Is able to select procetions sysems for electric drives | [SK5] Assessment of ability to solve problems that arise in practice |
| [K6_W03] knows the basics of automation and automatic regulation, knows the principles of the selection of electrical devices, drive systems and their control | Is able to do a technical analysis of the control systems for electric drives with adjustable speed in application to selected types of load mechanisms. | [SW1] Assessment of factual knowledge |

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| Subject contents | **Lectures.** Theory of electromechanical energy conversion. The general form of the equations of motion drive. Converting the torque to the motor shaft. Mechanical characteristics of electric motors and load machines. Drives with DC machines: output characteristics; power converters - choppers, rectifiers, control system, dual-area of drive operation, the sellection and tunning of the controllers. Classification of power converters for AC electric motors AC: frequency converters. Drives with induction motors: characteristics, start-up, speed control and braking; mechanical characteristics in case of inverter voltage and current type supply. Phenomena related to power a converter motors, dV / dt, bearing currents, motor filters. Induction motor control methods: control V / f = const. (scalar), field-oriented (vector) control to direct torque control (DTC), non-linear control (multiscalar). Sensorless control of induction motors. Drives with double fed induction machines: constant torqe cascade, hydroelectric power generators and wind turbines. Synchronous motor drives: properties, accelerating, braking, speed control. Drive systems with motors permanent magnet synchronous (PMSM). Drive systems of brushless DC motors (BLDCM). The properties and control of switched reluctance motor drives. The properties and control of switched reluctance motor drives.stepper motors. Transient analysis: start-up, change of speed and load. Concurrency of electric motors. Speed and shaft position sensors. mechanical coupling and gearboxes, motoreducers. Types of electric motors. Selection of electric motors for drive systems: heating, power calculation, supply cables, and protection. Cooling of electrical machines. Selection and configuration of frequency converters. Industrial drive systems: drives for pumps, fans, centrifuges, compressors, cranes. Electric drives vehicles. Fundamentals of computer simulation of electric drives.<br><br>**Laboratory.** DC drive with controlled rectifier. Scalar U/f control of induction motor. Electric drive with voltage inverter and induction motor - field oriented control (FOC). Programming of LS-iC5 frequency converter for operation in vehicle drive.<br><br>**Project.** Electric drive design for a selected type of load mechanism (presentation of the theory of the selected drive system, calculations, selection of elements, elboration of technical documentation, economic analysis, preparation of drive system simulation, preparation and presentation of a multimedia presentation) |
| Prerequisites and co-requisites | Basic knowleage on electrical machines, power electronics and control theory. |
| Assessment methods and criteria | |

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Final test | 60.0% | 50.0% |
| Project | 60.0% | 50.0% |

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| Recommended reading | Basic literature | 1. Austin Hughes and Bill Drury, Electric Motors and Drives - Fundamentals, Types and Applications, Elsevier, 2013.<br>2. Richard Crowder, Electric Drives and Electromechanical Systems, Elsevier 2006.<br>3. Bill Drury, Control Techniques Drives and Controls Handbook, The Institution of Electrical Engineers, London 2001. |
| | Supplementary literature | 1. Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, High Performance Control of AC Drives with MATLAB/Simulink Models, Wiley, 2012. |
| | eResources addresses | Adresy na platformie eNauczanie: |
| Example issues/ example questions/ tasks being completed | 1. Typical characteristics of the load torque. Examples of mechanisms.<br>2. Motor selection for periodically variable load.<br>3. Equivalent moment of inertia.<br>4. Methods for variable speed control for alternating current motors.<br>5. Selection of controller settings for electric drive.<br>6. The design of conveyor belt electrical drive. | |
| Work placement | Not applicable | |

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