GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Introduction to Advanced Electrical Drives, PG_00038331		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electric Drives and Energy Conversion -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Marcin Morawiec	
	Teachers	prof. dr hab. inż. Marcin Morawiec	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	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	15.0	50

Subject objectives

The aim is to understand the structures of modern electric drives as well as methods and tools for control like FOC control, flux and angular velocity observer, optimal control of electric machines.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W06] has an extended knowledge of the design of automation components and devices, control and decision support systems control and decision support systems and complex mechatronic systems	the student is able to design a simple electronic system, a control system for automation and a mechatronic system	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_K06] is aware of the impact of engineering activities on the quality of applied solutions and the environment	the student has information about the impact of machines and devices on the environment	[SK1] Assessment of group work skills [SK2] Assessment of progress of work

Subject contents

Course content – lecture

The cotrnol rules of the torque and flux in AC electrical machines, the basic structure of the control system, the principles of control with field weakening region. Structure and properties of the estimators variables: flux, load torque, angular speed and position. Decoupled control and feedback linearization. The efficiency of the electrical drive system, operation conditions with maximum efficiency. Implementation of digital control system. Diagnosis of the electric drives.

Course content – laboratory

1. Control of a Squirrel-Cage Induction Machine Using Field Vector Orientation
2. Control with Multiscalar Variables
3. Sliding Mode Control
4. Implementation of a Rotor Angular Velocity Observer
5. Analysis of Drive Operation in the Laboratory

Prerequisites and co-requisites

Basic knowledge of electrical engineering, electrical drives, power electronics and control theory including observers.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture</td><td>30.0%</td><td>30.0%</td></tr>
<tr><td>Laboratory</td><td>70.0%</td><td>70.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Materiały dydaktyczne do laboratorium i wykładów na eNauczaniu

2. Krzemiński Z.: Cyfrowe sterowanie maszynami asynchronicznymi, Gdańsk, Wydawnictwo PG, 2003.

3. Orłowska-Kowalska T.: Bezczujnikowe układy napędowe z maszynami asynchronicznymi, Oficyna Wydawnicza politechniki Wrocławskiej, 2005.

4. Zawirski K.: Układy napędowe z maszynami synchronicznymi, Wydawnictwo Politechniki Poznańskiej, Poznań, 2005.

5. Kowalski C.: Monitorowanie i diagnostyka uszkodzeń silników z wykorzystaniem sieci neuronowych, Oficyna wydawnicza Politechniki Wrocławskiej, 2005.</td></tr>
<tr><td>Supplementary literature</td><td>1. Bielawski C.: Automatyka napędu elektrycznego, WNT, 1980.

2. Abu Rub H., Guziński J., Iqbal J.: High performance control of AC drives with Matlab Simulink models, Willey, 2012.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. The vector model of an induction machine
2. List and evaluate known methods for reproducing flux in electric machines
3. What is the structure of an MRAS-type velocity estimator?</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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