



## Subject card

Subject name and code	Introduction to Advanced Electrical Drives, PG_00038322						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2023/2024		
Education level	second-cycle studies		Subject group		Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Part-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Marcin Morawiec				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	10.0	0.0	0.0	20
	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	20		4.0		26.0	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_U07		Is able to build a simulation model of a drive system with a given structure and assess the quality of control		[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		
	K7_K06		the student is able to adjust the solution to the task with the use of existing tools and is aware of the consequences of a wrong choice		[SK5] Assessment of ability to solve problems that arise in practice		
	K7_K04		The student is able to divide the work in a group in order to complete the task. Is aware of the dangers of electric machines and is able to work safely		[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work		
	K7_W10		the student understands the need for advanced methods of machine control and is able to justify it. Can describe the principle of operation and purpose of structures.		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
Subject contents	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.						
Prerequisites and co-requisites	Basic knowledge of electrical engineering, electrical drives, power electronics and control theory including observers.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Laboratory reports		100.0%		50.0%		
	Colloquium of the lecture		50.0%		50.0%		

Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Laboratory instructions and lectures reported in eNauczenie</li> <li>2. Krzemiński Z.: Cyfrowe sterowanie maszynami asynchronicznymi, Gdańsk, Wydawnictwo PG, 2003.</li> <li>3. Orłowska-Kowalska T.: Bezczylnikowe układy napędowe z maszynami asynchronicznymi, Oficyna Wydawnicza politechniki Wrocławskiej, 2005.</li> <li>4. Zawirski K.: Układy napędowe z maszynami synchronicznymi, Wydawnictwo Politechniki Poznańskiej, Poznań, 2005.</li> <li>5. Kowalski C.: Monitorowanie i diagnostyka uszkodzeń silników z wykorzystaniem sieci neuronowych, Oficyna wydawnicza Politechniki Wrocławskiej, 2005.</li> </ol>
	Supplementary literature	<ol style="list-style-type: none"> <li>1. Bielawski C.: Automatyka napędu elektrycznego, WNT, 1980.</li> <li>2. Abu Rub H., Guziński J., Iqbal J.: High performance control of AC drives with Matlab Simulink models, Wiley, 2012.</li> </ol>
	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Vector model of induction machine</li> <li>2. Features of the flux estimation methods</li> <li>3. What is the structure of the MRAS based speed estimator</li> </ol>	
Work placement	Not applicable	