



Subject card

Subject name and code	Introduction to Advanced Electrical Drives, PG_00038331						
Field of study	WPROWADZENIE DO ZAAWANSOWANEJ TECHNIKI NAPĘDOWEJ						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2025/2026		
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 -> Wydział Politechniki Gdańskiej						
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_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		[SK2] Ocena postępów pracy [SK1] Ocena umiejętności pracy w grupie		
	[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		[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym [SW2] Ocena wiedzy zawartej w prezentacji [SW1] Ocena wiedzy faktograficznej		
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.						
	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.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Laboratory		70.0%		70.0%		
	Lecture		30.0%		30.0%		

Recommended reading	Basic literature	1. Materiały dydaktyczne do laboratorium i wykładów na eNauczaniu 2. Krzemiński Z.: Cyfrowe sterowanie maszynami asynchronicznymi, Gdańsk, Wydawnictwo PG, 2003. 3. Orłowska-Kowalska T.: BezczyJNIkOWe 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.
	Supplementary literature	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, Wiley, 2012.
	eResources addresses	
Example issues/ example questions/ tasks being completed	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?	
Practical activities within the subject	Not applicable	

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