



Subject card

Subject name and code	Drives Supplied by Power Converters, PG_00016900						
Field of study	Electrical Engineering						
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		5.0		
Learning profile	general academic profile		Assessment form		exam		
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	30.0	0.0	30.0	0.0	0.0	60
	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	60		7.0		58.0	125
Subject objectives	Study of advanced electrical machine control systems with taking under consideration a sensorless control.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U07] is able to analyse, calculate, design, program and test converters, drive systems, control systems and state observers		the student is able to program a power electronic converter, implement a control system, and a state observer		[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K7_W06] has an in-depth knowledge of industrial electronics, microprocessor control systems and in the field of power electronics and drive systems, their control and diagnostic methods		the student has knowledge of control systems and power electronics and drive systems, their control and diagnostic methods		[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	[K7_K03] can interact and work in a group assuming various roles and identify priorities for the achievement of a specific task		the student is able to cooperate in a group and coordinate work appropriately in order to achieve tasks		[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work [SK1] Assessment of group work skills		

Subject contents	Course content – lecture Transformation of phase systems to orthogonal systems. Space vector. Methods for generation of voltage inverter output voltage. Control systems for a voltage source inverter output current. Structures of field oriented control and direct torque control of induction motor. Induction motor control principle of a fixed ratio U / f. High-power drive systems with induction motor. Control systems for double fed induction machine. Control systems for synchronous machine. Control systems for synchronous machines with permanent magnets. Construction of switched reluctance motors. Power suppliers for switched reluctance motors. Start-stop and synchronous control of stepper motor. Principles of controllers based on fuzzy logic. The use of neural networks and fuzzy logic in the control drives. Course content – laboratory 1. DC chopper control. 2. DC motor control. 3. Torque control of a separately excited DC motor. 4. Pulse-width modulation in a voltage inverter. 5. Scalar control of a squirrel-cage induction machine. 6. Vector control of a squirrel-cage machine. 7. Implementation of a state observer. 8. Sensorless control of a squirrel-cage induction motor.		
Prerequisites and co-requisites	Ability to program in C.Knowledge of power electronics, electronics and digital technology.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	60.0%	40.0%
	Egzam	60.0%	60.0%
Recommended reading	Basic literature	1. Krzemiński Z.: Digital control of induction machines. Wydawnictwo Politechniki Gdańskiej. PAN, Komitet Elektrotechniki, Seria Wydawnicza "Postępy Napędu Elektrycznego i Energoelektroniki" Tom 45. 2001. 2. Orłowska-Kowalska T., Sensorless drive systems with induction motors, Oficyna Wydawnicza Politechniki Wrocławskiej, Seria Wydawnicza Komitetu Elektrotechniki PAN Postępy Napędu Elektrycznego i Energoelektroniki T. 48, Wrocław 2003. 3. Zawirski K.: Układy napędowe z maszynami synchronicznymi, Wydawnictwo Politechniki Poznańskiej, Poznań, 2005. 4. Kowalski Cz.: Monitorowanie i diagnostyka uszkodzeń silników z wykorzystaniem sieci neuronowych, Oficyna wydawnicza Politechniki Wrocławskiej, 2005.	

	Supplementary literature	1. T. Raghu, J. Srinivas Rao, and S. Chandra Sekhar: Simulation of Sensorless Speed Control of Induction Motor Using APFO Technique. International Journal of Computer and Electrical Engineering, Vol. 4, No. 4, August 2012. 2. Dušan Graovac, Marco Pürschel: IGBT Power Losses Calculation Using the Data-Sheet Parameters. Infineon. Application Note, V 1.1, January 3. Tobias Geyer and Georgios Papafotiou: Direct Torque Control for Induction Motor Drives: A Model Predictive Control Approach Based on Feasibility. M. Morari and L. Thiele (Eds.): HSCC 2005, LNCS 3414, pp. 274290, 2005. Springer-Verlag Berlin Heidelberg 2005. 4. Bhoopendra Singh, Shailendra Jain, and Sanjeet Dwivedi: Direct Torque Control Induction Motor Drive with Improved Flux Response. Hindawi Publishing Corporation. Advances in Power Electronics. Volume 2012, Article ID 764038, 11 pages. doi: 10.1155/2012/764038. 5. Atul Kumar Dewangan, Durga Sharma, Shikha Mishra: PID Controller Based Chopper-Fed DC Motor Drive Using Fuzzy Logic. Atul Kumar Dewangan, Durga Sharma, Shikha Mishra/ International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com. Vol. 2, Issue 3, May-Jun 2012, pp.1073-1081. 6. Qiang Ling, Jing Li, and Haojiang Deng: Robust Speed Tracking of Networked PMSM Servo Systems with Uncertain Feedback Delay and Load Torque Disturbance. Hindawi Publishing Corporation Journal of Applied Mathematics Volume 2012, Article ID 65923, 17 pages. doi:10.1155/2012/365923. 7. J. Liang, L. Jian, G. Xu, and Z. Shao: Analysis of electromagnetic behavior in switched reluctance motor for the application of integrated air conditioner onboard charger system. Progress In Electromagnetics Research, Vol. 124, 347{364, 2012.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Sensorless control of the induction motor. 2. Control system of the double-fed machine. 3. The control system of the DC machine with armature current limitation. 4. Control of the rotor angular speed of the synchronous machine. 5. Direct torque control of induction motor	
Practical activities within the subject	Not applicable	

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