GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Drives Supplied by Power Converters, PG_00016900						
Field of study	Electrical Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject	2023/2024			
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 Controlled Electric Drives -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Marcin Morawiec					
	Teachers	prof. dr hab. inż. Marcin Morawiec dr hab. inż. Arkadiusz Lewicki					
Lesson types and methods of instruction	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_W10	The student analyzes the work and control methods of power electronic power converters. Analyzes the influence of the properties of power converters on the accuracy of generating output voltage / current vectors. Analyzes and simulates the operation of closed control systems for electric drive powered by power converters. Describes the behavior of electrical machine control systems in transient states. Selects the settings of regulators and limitations in the closed-loop control of the drive. It runs selected electric drive control systems on power converters.	[SW1] Assessment of factual knowledge
K7_U07	The student analyzes the drive systems presented in the publications. Evaluates the properties of drive systems with different control structures for AC machines. Analyzes the structure of sensorless control systems.	[SU2] Assessment of ability to analyse information
K7_W13	The student analyzes the work and control methods of power electronic power converters. Analyzes the influence of the properties of power converters on the accuracy of generating output voltage / current vectors. Analyzes and simulates the operation of closed control systems for electric drive powered by power converters. Describes the behavior of electrical machine control systems in transient states. Selects the settings of regulators and limitations in the closed-loop control of the drive. It runs selected electric drive control systems on power converters.	[SW1] Assessment of factual knowledge

Subject contents

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.

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
Egzam	60.0%	60.0%
Laboratory	60.0%	40.0%

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.

	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 InductionMotor 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	Adresy na platformie eNauczanie: Napędy o zasilaniu przekształtnikowym - Moodle ID: 1878 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=1878
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	
Work placement	Not applicable	