GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	DRIVES SUPPLIED BY POWER CONVERTERS I, PG_00038370		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2023	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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
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	dr inż. Marcin Drzewiecki	
	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	6.0	49.0	75

Subject objectives

Get knowledge of the selected problem of the electric drives with converter type supply.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W13	Has knowledge about the construction and operation of drive converters. He knows the problems of generation of the output voltage of inverters. He understands the problems connected with the power supply a converter. He knows the control structures of DC and AC drives. He knows the issues of modeling electric drives.	[SW1] Assessment of factual knowledge
K7_W10	Student has an expanded and theoretically founded knowledge in the field of propulsion systems and their control methods.	[SW3] Assessment of knowledge contained in written work and projects
K7_U07	Student can analyze, calculate, design, program and examine converters, drive systems, control systems and conditioners.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents	**Lectures** Selected problems related to electric drives with power electronic converters supply. Power electronics converters: inverters, rectifiers, structure, operation, control. AC/AC direct converters. Control of current of voltage inverter. Asynchronous motor model. Motor control methods: field oriented control, direct torque control. Problem of nonlinear control. State variables estimation, speed observers. Control and estimation in drives with motor filters. Diagnostic in drives with converters type supply.. Problems with converter type supply, bearing currents. Differential and common mode motor filters. Filter design. Filter influence on drives control. **Laboratory** Modeling and investigation of induction motor drive. Programming of field oriented control method. Programming of multiscalar control method. Tuning of electric drive controllers. Implementation of state observer. Investigations of sensorless drive.
Prerequisites and co-requisites	The basic knowledge on electric machines, electric drives, power electronics and automatics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written and oral exam	60.0%	60.0%
Practical exercise	60.0%	40.0%

Recommended reading

Basic literature	1. Sieklucki G., Bisztyga B., Zdrojewski A., Orzechowski T., Sykulski R.: Modele i zasady sterowania napędami elektrycznymi. Wydawnictwo AGH, Kraków 2014. 2. Krzemiński Z. Cyfrowe sterowanie maszynami asynchronicznymi. Gdańsk, Wyd. PG 2001. Rozdział 5: Realizacja źródeł prądu i napięcia; Rozdział 6: Modele matematyczne maszyn asynchronicznych. Wersja elektroniczna dostępna na stronie Katedry Automatyki Napędu Elektrycznego: http:// www.ely.pg.gda.pl/kane/Monografia.pdf 3. Zwierchanowski: R., KaźmierkowskiM.P., Kalus M.: Polski program efektywnego wykorzystania energii w napędach elektrycznych PEMP. Krajowa Agencja Poszanowania Energii S.A., Warszawa 2004. Rozdział II: Nowoczesne energooszczędne układy sterowania i regulacji napędów z silnikami indukcyjnymi klatkowymi. Wersja elektroniczna dostępna na stronie stronie Polskiego Programu Efektywnego Wykorzystania Energii w Napędach Elektrycznych PEMP: http://www.portal.pemp.pl/ biblioteka 4. Zawirski K., Deskur J., Kaczmarek T.: Automatyka napędu elektrycznego, Wydawnictwo Politechniki Poznańskiej, Poznań 2012. 5. Teaching materials available on the web page of the lecturer.
Supplementary literature	1. Abu-Rub H., Iqbal A., Guzinski J.: High Performance Control of AC Drives with MATLAB/Simulink Models. Wiley, United Kingdom 2012. 2. Orłowska-Kowalska T: Bezczujnikowe układy napędowe z silnikami indukcyjnymi. Wrocław, Oficyna Wydawnicza PW 2003. 3. Citko T.: Analiza układów energoelektroniki. Wydawnictwo Politechniki Białostockiej, Białystok 1992. 4. Tunia H., Kaźmierkowski M. Automatyka napędu przekształtnikowego. PWN, Warszawa 1987. 5. Grunwald Z. (red): Napęd Elektryczny. WNT, Warszawa 1987.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. Induction motor control methods. 2. Permanent magnet synchronous motor control methods. 3. The structure and operation of the current converter. 4. The voltage inverter output current control. 5. The structure of the field oriented control of induction motor. 6. Nonlinear multiscalar control of the induction motor. 7. The estimation of state variables in drives with induction motor. 8. The estimation of state variables in drives with PMSM motor.. 9. Dead time in voltage inverter – the influence on drive operation, compensation methods zero current switching. 10. Common mode voltage in electric drive with voltage inverter. 11. Bearing currents and shaft voltage. 12. Voltage inverter output current - the aim of use, structure, influence on drive operation. 13. Diagnostic in electric drives with observer use.
Work placement	Not applicable