GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Advanced Control of Electric Drives and Battery Charging Systems, PG_00070185		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
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 -> 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	20.0	0.0	15.0	0.0	0.0	35

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 8968 Zaawansowane sterowanie napędami elektrycznymi i systemami ładowania akumulatorów https://enauczanie.pg.edu.pl/2025/course/view.php?id=8968

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	35	2.0	13.0	50

Subject objectives

The aim of the course is to discuss the control of electric drives and battery charging systems

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the hydrogen devices, systems, installations, and automation systems	The outcome of the course will be an understanding of the control principles for selected electrical machines and battery charging systems.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of hydrogen technologies and electromobility, and organization of work of systems using computers or such devices	Implementation of control for electric machines or power electronic converters on a signal processor or microcontroller	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of hydrogen technologies and electromobility, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Design of selected power electronic devices and control systems for electric drives or chargers	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
[K7_U07] can apply advanced methods of process and function support, specific to the field of hydrogen technologies and electromobility	Proficiency in advanced software for designing control systems	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents

Course content – lecture

1. General information on electric vehicle powertrains
2. Linear controllers and criteria for selecting controller settings
3. BLDC motors: characteristics and control methods
4. Selected AC voltage and current converter topologies
5. Scalar control of induction motors
6. Vector control (FOC)
7. Speed estimation for squirrel-cage induction motors
8. Permanent magnet machines (PMSM/IPMSM) and reluctance motors
9. Selected power electronics circuits in battery charging systems
10. Control of battery charging systems

Course content – laboratory

1. Modeling a charging system using a DC chopper in the PLECS environment
2. DC motor control
3. Squirrel-cage induction motor control – scalar and vector
4. Battery charger modeling and control

Prerequisites and co-requisites

Knowledge of the fundamentals of electrical engineering and automation

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	60.0%	100.0%

Recommended reading

Basic literature

1. Zawirski K., Deskur J., Kaczmarek T.: Automatyka napędu elektrycznego. Wyd. Politechniki Poznańskiej, Poznań 2012.
2. Nowak M., Barlik R.: Poradnik inżyniera - energoelektronika. WNT, Warszawa 1998.
3. Guzinski J.: Układy napędowe z silnikami indukcyjnymi i filtrami wyjściowymi falowników napięcia - zagadnienia wybrane. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2011.
4. Drury B.: Control Techniques Drives and Controls Handbook. The Institution of Electrical Engineering. London 2001.
5. Wu B.: High-Power Converters and AC Drives. John Wiley & Sons 2006.

	Supplementary literature	Publications on the web-site. Abu-Rub H., Iqbal A., Guzinski J.: High Performance Control of AC Drives with MATLAB/Simulink Models. Wiley, United Kingdom 2012.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. DC motor control system 2. PMSM motor control 3. List and describe the basic power electronic circuits used in chargers 4. What is a charging curve?	
Practical activites within the subject	Not applicable	

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