GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modeling and computer simulation in power electronic systems, PG_00044112		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	English
Semester of study	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Musznicki	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	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

Get basic knowledge and skill on circuit oriented modelling and simulation of power electronic systems

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_K01	Expands teamwork skills and presentation of project results.	[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness
K6_U10	Is able to define a model of energy conversion devices and enter it into a simulation program	[SU4] Assessment of ability to use methods and tools
K6_U09	Defines the type of model depending on the expected results. Selects the simulation program and numerical methods.	[SU1] Assessment of task fulfilment
K6_W10	Defines the capabilities of circuit simulation programs. Can build a power converter model. Defines simulation circuit parameters. Interprets simulation results.	[SW1] Assessment of factual knowledge
K6_K05	Determines the numerical stability of simulation systems and rejects erroneous results.	[SK2] Assessment of progress of work

<table>
<tr><td>Subject contents</td><td>Lecture:

1) Classification of modeling levels: components, behavioral, functional and wide-band. Numerical methods for solving dynamic systems.2) Simulation methods for converter systems. Review of universal simulation programs.3) Specification of element parameters in the program: resistor, capacitor, coil, transformer, power electronic switches. Models of electric machines, loads and control systems.4) Simulation in the time domain, small signal and with sweeping of selected parameters.5) Optimization and parametric modeling.6) User-defined models7) Circuit models of field phenomena for testing PCBs

Project: As part of the project, a voltage converter model will be built in a selected circuit simulation program.

1. Selection of simulation program. 2. Determination of voltage converter topology. 3. Selection of system components. 4. Construction of control and modulation model. 5. Construction of inverter model. 6 Selection of network filter. 7. Final tests.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge on power electronics and electrical drives.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>lecture</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>project</td><td>50.0%</td><td>60.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. R. Szczęsny, Komputerowa symulacja układów energo-elektronicznych, Wydawnictwo Politechniki Gdańskiej 1999.

2. M. Wilamowski, J.David Irwin (ed.) The industrial Electronics Handbook: Power electronics and motor drives, CRC Taylor & Francis Group 2nd edition 2011

3. Francisco M. Gonzalez-Longatt, José Luis Rueda Torres Modelling and Simulation of Power Electronic Converter Dominated Power Systems in PowerFactory Power Systems 2021</td></tr>
<tr><td>Supplementary literature</td><td>1. Farzin Asadi, Kei Eguchi Simulation of Power Electronics Converters Using PLECS® ISBN: 9780128173640 1st Edition - November 8, 2019

2. A.-R. Haithem, A. Iqbal, J. Guziński, High performance control of ac drives with Matlab/Simulink, John Wiley & Sons 2021</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Explain differences between behavioral and functional modeling on the example of pulse width modulation voltage source inverter.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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