



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 2024	Academic year of realisation of subject			2026/2027		
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Piotr Musznicki				
	Teachers						
Lesson types	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_K05	Determines the numerical stability of simulation systems and rejects erroneous results.			[SK2] Assessment of progress of work		
	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_U09	Defines the type of model depending on the expected results. Selects the simulation program and numerical methods.			[SU1] Assessment of task fulfilment		
	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_K01	Expands teamwork skills and presentation of project results.			[SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills		

Subject contents	<p>Course content – lecture Lecture:</p> <p>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</p> <p>Project: As part of the project, a voltage converter model will be built in a selected circuit simulation program.</p> <p>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.</p>											
Prerequisites and co-requisites	Basic knowledge on power electronics and electrical drives.											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="451 734 794 763">Subject passing criteria</th> <th data-bbox="794 734 1137 763">Passing threshold</th> <th data-bbox="1137 734 1487 763">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 763 794 792">project</td> <td data-bbox="794 763 1137 792">50.0%</td> <td data-bbox="1137 763 1487 792">60.0%</td> </tr> <tr> <td data-bbox="451 792 794 835">lecture</td> <td data-bbox="794 792 1137 835">50.0%</td> <td data-bbox="1137 792 1487 835">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	project	50.0%	60.0%	lecture	50.0%	40.0%
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lecture	50.0%	40.0%										
Recommended reading	Basic literature	<p>1. R. Szczęsny, <i>Komputerowa symulacja układów energo-elektronicznych</i>, Wydawnictwo Politechniki Gdańskiej 1999.</p> <p>2. M. Wilamowski, J.David Irwin (ed.) <i>The industrial Electronics Handbook: Power electronics and motor drives</i>, CRC Taylor &amp; Francis Group 2nd edition 2011</p> <p>3. Francisco M. Gonzalez-Longatt, José Luis Rueda Torres <i>Modelling and Simulation of Power Electronic Converter Dominated Power Systems in PowerFactory</i> Power Systems 2021</p>										
	Supplementary literature	<p>1. Farzin Asadi, Kei Eguchi <i>Simulation of Power Electronics Converters Using PLECS®</i> ISBN: 9780128173640 1st Edition - November 8, 2019</p> <p>2. A.-R. Haithem, A. Iqbal, J. Guziński, <i>High performance control of ac drives with Matlab/Simulink</i>, John Wiley &amp; Sons 2021</p>										
	eResources addresses											
Example issues/ example questions/ tasks being completed	Explain differences between behavioral and functional modeling on the example of pulse width modulation voltage source inverter.											
Practical activities within the subject	Not applicable											

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