



Subject card

Subject name and code	Modelling and Simulation of Electromechatronic Systems, PG_00048273						
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		Polish		
Semester of study	5		ECTS credits		6.0		
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 inż. Krzysztof Iwan				
	Teachers						
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		5.0		85.0	150
Subject objectives	The aim of the course is for the student to acquire knowledge and skills related to computer analyzes of processes characteristic of electrical engineering. The student will find the use of numerical methods, learn about the types of numerical analyzes used in electrical engineering and learn the currently recognized as leading programs for simulating processes occurring in selected, currently used devices. In addition, the student will master the skills of independent simulation of the indicated (or selected by the student) circuit-oriented issue.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_K05		carries out the laboratory exercise program in compliance with the regulations		[SK5] Assessment of ability to solve problems that arise in practice		
	K6_U09		selects the components of the analyzed model taking into account the obtained long-term, transient and short-circuit loads		[SU1] Assessment of task fulfilment		
	K6_U10		analyzes low voltage systems, selecting components taking into account current regulations and standards		[SU1] Assessment of task fulfilment		
	K6_K01		determines the level of model simplification and selects a simulation program		[SK2] Assessment of progress of work		
	K6_W10		selects parameters of models of transport system components		[SW3] Assessment of knowledge contained in written work and projects		

Subject contents	LECTURE: Classification of modeling levels: components, behavioral, functional. Methods of numerical solution of dynamic systems. Simulation methods of converter systems. Review of sample circuit simulation programs: PLECS, PSIM, TCad. Specification of parameters of elements in circuit simulators, including: resistor, capacitor, coil, transformer, power electronic switches and electrical machines. Models of electrical machines, mechanical loads and control systems. Functional models of systems. Implementation of model components through your own user definitions. LAB: Modeling, simulation and results analysis (MSA) of selected passive filters. MSA of systems with nonlinear components on the example of active filters. MSA of the local LV power grid. MSA of a fragment of the power grid with LV, HV, MV and LV components. Synthesis of a nonlinear component circuit model based on a physical model. Simulation and analysis of model results of selected drive systems. MSA of selected converter systems. Development of control modules as DLL blocks.		
Prerequisites and co-requisites	Knowledge and skills in the field of numerical methods and basics of electrical engineering. Additionally, knowledge about electrical apparatus and devices.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		50.0%	40.0%
		50.0%	60.0%
Recommended reading	Basic literature Szczęsny R., Komputerowa symulacja układów energoelektronicznych, Wydawnictwo Politechniki Gdańskiej, Gdańsk 1999, Osowski S., Modelowanie i symulacja układów i procesów dynamicznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007, Praca zbiorowa, Wybrane metody modelowania i symulacji, red. Nita K., Instytut Elektrotechniki, Wydawnictwo Książkowe Instytutu Elektrotechniki, Warszawa 2013, Matyka M., Symulacje komputerowe w fizyce, . Helion, Gliwice 2021.		

	Supplementary literature	Modelowanie i symulacja układów napędowych i energoelektronicznych, Polska Akademia Nauk. Komitet Elektrotechniki, Wydaw. Politechniki Lubelskiej, Lublin 2002 Cieślak S., Modelowanie matematyczne i symulacja układów elektroenergetycznych z generatorami indukcyjnymi, Wydawnictwa Uczelniane Uniwersytetu Technologiczno-Przyrodniczego, Bydgoszcz 2008, Judek S., Karwowski K., Lipiński Lech., Miszewski M., Modelowanie i symulacja napędów elektrycznych kolejowych pojazdów trakcyjnych z silnikami indukcyjnymi, Rail Vehicles, 2011-08 (3), p.25-29, Systemy elektroenergetyczne: modelowanie, symulacja i symulatory, eksploatacja i współpraca, Międzynarodowa Konferencja Naukowa APE9 , Jurata 1999, Nowak M., Roman Barlik R., Poradnik inżyniera energoelektronika. Wydawnictwa Naukowo-Techniczne, Warszawa 2014, Symulacja procesów dynamicznych : prace IX Symposium SPD-9, Polana Chochołowska 10-14 czerwca 1996, Warszawa : PTETiS. OW 1996, Szymański G., Symulacja cyfrowa niebezpiecznych oddziaływań stacji i linii wysokich napięć, Wydawnictwo Politechniki Poznańskiej, Poznań 1998, Demenko A., Symulacja dynamicznych stanów pracy maszyn elektrycznych w ujęciu polowym, Wydaw. Politechniki Poznańskiej, Poznań 1997, Sowa P., Modelowanie dynamiczne układów elektroenergetycznych : laboratorium modelowania cyfrowego : zastosowanie programu EMTP (ElectroMagnetical Transients Program), Wydaw. Politechniki Śląskiej, Gliwice 1992, Praca zbiorowa, Laboratorium modelowania układów elektromechanicznych i energoelektronicznych, red. Krykowski K., oprac. Grzesik B., Wydawnictwo Politechniki Śląskiej, Gliwice 1993, Matulewicz W., Modelowanie krwioobiegu za pomocą obwodu elektrycznego, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2010, Szczeciński P., Zajczyk R., Modele matematyczne do badania bezpieczeństwa systemu elektroenergetycznego. ,Wydawnictwo Politechniki Gdańskiej, Gdańsk 2012.
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Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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