



Subject card

Subject name and code	Modelling and Simulation in Mechatronics, PG_00038122						
Field of study	Automation, Robotics and Control Systems						
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			Polish		
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. Michał Michna				
	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		2.0		18.0	50
Subject objectives	The aim of the course is to learn how to develop a model of the electromechanical system, perform simulations, interpret the results and to compare them with the results of measurements						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W07] has basic knowledge related to control and automation systems		Selects the appropriate control system to control an electric motor. Selects regulator settings. Assesses the correctness of the control system operation. Explains the differences in simulation and laboratory test results		[SW3] Assessment of knowledge contained in written work and projects		
	[K6_K02] can work in a group taking on different roles in it		Organizes team work. Selects appropriate methods for solving a problem. Exchanges information with team members		[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice		
	[K6_U07] can build and analyze models of systems and systems in the field related to control systems and automation		Uses appropriate specialist literature. Identifies important elements of a mechatronic system. Develops mathematical models of system elements. Selects appropriate simulation methods and tools. Prepares a simulation scheme. Analyses simulation results. Explains differences between simulation and laboratory test results.		[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment		
Subject contents	Course content – lecture Lecture Basic definition and terms: physical model, mathematical model, simulation, design. Modelling and simulation process. Modeling language for component-oriented modeling of complex mechatronic systems: Unified Modeling Language, Modelica, hardware description language (VHDL, MAST). Modeling level of abstraction: functional, behavioral, structural... Lagrange"a approach to modeling, bond graphs, block diagrams. Modeling simulation and CAD environments: PSpice, 20-sim, Dymola, Psim, Matlab/Simulink, Synopsys/Saber, Cedrat/Flux, VectorFields/Opera, Autodesk/AutoCAD Inventor. Project: Team tasks (2-3 persons) associated with modeling and simulations of the chosen mechatronic car system: power drive system, wiper drive, modeling the flow of energy on the example of hybrid vehicle propulsion. Possibility of a virtual tour inside the nacelle of a wind turbine and manipulating components of real electric machines using VR goggles and the application available on the eNauczanie platform.						
Prerequisites and co-requisites							

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	100.0%	80.0%
	Midterm colloquium	60.0%	20.0%
Recommended reading	Basic literature	1. Turowski J. : Podstawy mechatroniki. Wydawnictwo Wyższej Szkoły Humanistyczno-Ekonomicznej w Łodzi, 2008. 2. Teaching materials published on the website www.ely.pg.gda.pl/e-mechatronika	
	Supplementary literature	1. Bishop Robert H. (Editor): The Mechatronics Handbook. CRC Press, 2002. 2. Damic V., Montgomery J.: Mechatronics by Bond Graphs. An object approach to modeling and simulation. Springer 2003. 3. Fishwick Paul A.: Handbook of Dynamic System Modeling. Chapman & Hall/CRC 2007 4. Fritzson Peter: Principles of Object-Oriented Modeling with Simulation with Modelica. J. Wiley&Sons 2004. 5. Karnopp D. C., Margolis D. L., Rosenberg R. C.: System Dynamics, Modelling and simulation of mechatronic systems, John Wiley Inc, 2000. 6. Lyshevski S. E.: Electromechanical Systems, Electric Machines, and Applied Mechatronics, CRC Press, 2000. 7. Nieznański J., Szczęsny R., Iwan K.: TCad for Windows: High-Performance Power Electronic Simulation Software. Softech, Gdańsk 1996. 8. Ronkowski M., Makowski S.: Modelling of energy flow in mechatronic systems. A bond graph approach. Podstawowe Problemy Energoelektroniki Elektromechaniki i Mechatroniki PPEEm'2007. Archiwum Konferencji PTETIS, vol.24, T. II, s. 211-216. 9. Ronkowski M., Kostro G., Michna M, Wilk A: Modelowanie i symulacja w mechatronice. Materiały dydaktyczne do wykładów i projektowania. PG 2009 (w opracowaniu) http://wat3.ely.pg.gda.pl/maszyny/ 10. ŚWITONSKI E. (red.): Modelowanie mechatronicznych układów napędowych. Wydawnictwo Politechniki Śląskiej 2005. 11. Dymola. http://www.dymola.com 12. Modelica. http://www.modelicca.org 13. Synopsys/Saber. http://www.synopsys.com	
	eResources addresses		
	Example issues/ example questions/ tasks being completed	modelling and simulation of the DC motor drive system (power supply and control system)	
Practical activites within the subject	Not applicable		

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