



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 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			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						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Michał Michna				
	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		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		The student selects the appropriate control system to control the electric motor. The student is able to select the settings of the regulators. The student is able to assess the correct operation of the control system. The student explains the differences in the results of simulation and laboratory tests		[SW3] Assessment of knowledge contained in written work and projects		
	[K6_U07] can build and analyze models of systems and systems in the field related to control systems and automation		The student selects and uses the appropriate specialist literature. Student identifies the essential elements of mechatronic system. Student develops mathematical models of the system components. Student lists parameters of the system components models. Student chooses the appropriate methods and tools for simulation. Student prepares the simulation diagram. Student presents and analyzes the simulation results. The student explains the differences in the results of simulation and laboratory tests		[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools		
	[K6_K02] can work in a group taking on different roles in it		The student organizes work in a team. The student chooses the appropriate methods of solving the problem. The student exchanges information with the team members		[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills		

Subject contents	<b>Lecture</b> 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's 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.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	60.0%	20.0%
	Project	100.0%	80.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Turowski J. : Podstawy mechatroniki. Wydawnictwo Wyższej Szkoły Humanistyczno-Ekonomicznej w Łodzi, 2008.</li> <li>2. Teaching materials published on the website <a href="http://www.ely.pg.gda.pl/e-mechatronika">www.ely.pg.gda.pl/e-mechatronika</a></li> </ol>	
	Supplementary literature	<ol style="list-style-type: none"> <li>1. Bishop Robert H. (Editor): The Mechatronics Handbook. CRC Press, 2002.</li> <li>2. Damic V., Montgomery J.: Mechatronics by Bond Graphs. An object approach to modeling and simulation. Springer 2003.</li> <li>3. Fishwick Paul A.: Handbook of Dynamic System Modeling. Chapman &amp; Hall/CRC 2007</li> <li>4. Fritzson Peter: Principles of Object-Oriented Modeling with Simulation with Modelica. J. Wiley&amp;Sons 2004.</li> <li>5. Karnopp D. C., Margolis D. L., Rosenberg R. C.: System Dynamics, Modelling and simulation of mechatronic systems, John Wiley Inc, 2000.</li> <li>6. Lyshevski S. E.: Electromechanical Systems, Electric Machines, and Applied Mechatronics, CRC Press, 2000.</li> <li>7. Nieznański J., Szczęsny R., Iwan K.: TCad for Windows: High-Performance Power Electronic Simulation Software. Softech, Gdańsk 1996.</li> <li>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.</li> <li>9. Ronkowski M., Kostro G., Michna M, Wilk A: Modelowanie i symulacja w mechatronice. Materiały dydaktyczne do wykładów i projektowania. PG 2009 (w opracowaniu) <a href="http://wat3.ely.pg.gda.pl/maszyny/">http://wat3.ely.pg.gda.pl/maszyny/</a></li> <li>10. ŚWITONSKI E. (red.): Modelowanie mechatronicznych układów napędowych. Wydawnictwo Politechniki Śląskiej 2005.</li> <li>11. Dymola. <a href="http://www.dymola.com">http://www.dymola.com</a></li> <li>12. Modelica. <a href="http://www.modelica.org">http://www.modelica.org</a></li> <li>13. Synopsys/Saber. <a href="http://www.synopsys.com">http://www.synopsys.com</a></li> </ol>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	modelling and simulation of the DC motor drive system (power supply and control system)		
Work placement	Not applicable		