GDAŃSK UNIVERSITY OF TECHNOLOGY

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 -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Michna	
	Teachers	dr hab. inż. Michał Michna dr hab. inż. Piotr Musznicki	

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

eNauczanie source addresses:
Moodle ID: 815 MODELOWANIE I SYMULACJA W MECHATRONICE [ARiSS][2025/26]
https://enauczanie.pg.edu.pl/2025/course/view.php?id=815

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_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.	[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	Organizes team work. Selects appropriate methods for solving a problem. Exchanges information with team members	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills
[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

<table>
<tr><td>Subject contents</td><td colspan="2">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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="2"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Midterm colloquium</td><td>60.0%</td><td>20.0%</td></tr>
<tr><td>Project</td><td>100.0%</td><td>80.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>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. ŚWITOŃSKI 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</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">modelling and simulation of the DC motor drive system (power supply and control system)</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.