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 2021	Academic year of realisation of subject	2023/2024
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	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

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_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.	[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	he 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	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[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

Subject contents	**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.
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	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. 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
eResources addresses	Adresy na platformie eNauczanie: MODELOWANIE I SYMULACJA W MECHATRONICE [2023/24] - Moodle ID: 32144 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32144

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