GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00052095		
Field of study	Nanotechnology		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Mechatronics -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Krzysztof Kaliński	
	Teachers	prof. dr hab. inż. Krzysztof Kaliński dr inż. Tomasz Fąs	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	0.0	45

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 4309 Modelowanie układów mechatronicznych, W, Nano, Ist, sem. 06, lato, 2025/26, (PG_00052095)
https://enauczanie.pg.edu.pl/2025/course/view.php?id=4309

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	45	5.0	50.0	100

Subject objectives

Familiarizing students with the modeling of mechatronic systems

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U04	The student develops models physical layouts mechatronics	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
K6_W09	The student identifies phenomena related to functioning mechatronic systems	[SW1] Assessment of factual knowledge
K6_U05	The student recognizes the methods modeling the structure of systems and mechatronics observed signals	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Vibrations of systems with one degree of freedom. Free vibrations without damping. Free vibrations with viscous damping. Forced harmonic vibrations.
Vibrations of systems with two degrees of freedom. Free vibrations. Forced vibrations. Elimination of mechanical vibrations.
Discrete modeling. Fundamentals of the finite element method. The concept of modal models.
Modeling control systems. Modal control at energy performancey index. Design of control systems.
Selection of poles of the controlled system.
Examples of modeling mechatronic systems. Robot carrying system. Supervising vibrations of rail vehicle pantographs.

Course content – laboratory
Methods of modeling a two-mass system with elastic and damping elements. Transfer function model (Matlab). Differential equation model (Matlab). Transfer function model (Simulink). Solving differential equations (Simulink). Physical model (Simulink) using the Simscape Foundation Library. Physical model (Simulink) using the Simscape Multibody library.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge and skills in the subjects "Solid State Mechanics" and "Mechatronic Design"</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Lecture - 2 written colloquia</td><td>50.0%</td><td>66.0%</td></tr><tr><td>Passing the laboratory</td><td>100.0%</td><td>34.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td>Basic literature</td><td>1. Heimann B., Gerth W., Popp K.: Mechatronics. Components methods examples. Warsaw: PWN Scientific Publishing House 2001.
2. Gawrysiak M.: Mechatronics and mechatronic design. Białystok: Białostocka Polit. Publishing House 1997. (is available on the internet)
3. Cannon R. H.: Dynamics of physical systems. Warsaw: WNT 1973.
4. Kaliński K. J.: Supervision of dynamic processes in mechanical systems (2nd Edition verified). Gdańsk: Gdańsk University of Technology Publishing House 2026.
5. Kruszewski J., Wittbrodt E.: Vibrations of mechanical systems in a computer approach. Volume I. Linear problems. Warsaw: WNT 1995.
6. Kaczorek T.: Control and systems theory. Warsaw: PWN Scientific Publishing House 1993.</td></tr>
<tr><td></td><td>Supplementary literature</td><td>1. Mechatronics. Analysis, design and testing of selected elements and systems. (Ed. K. Kluszczyński). Warsaw: Wydawnictwo PAK 2013.
2. Skoczyński W.: Sensors in CNC machine tools. Warsaw: Wydawnictwo Naukowe PWN S.A. 2018.
3. Grzegożek W., Adamiec-Wójcik I., Wojciech S.: Computer modeling of automotive vehicle dynamics. Krakow: Tadeusz Kościuszko University of Technology, Krakow 2003.</td></tr>
<tr><td></td><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Mechanical vibrations. Natural vibrations with the mass of the spring element taken into account.
2. Vibrations forced by a rotating unbalanced mass.
3. Elimination of mechanical vibrations. General description.
4. Modal control at energy performance index in a reduced system.
5. Modeling of the robot carrying system. Modeling of the response.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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