GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00056110		
Field of study	Mechatronics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
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	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Rafał Hein	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	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	0.0	0.0	30

Subject objectives

The aim of the course is to present the methods of modeling and solving differential equations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W11] has a basic knowledge about the life cycle of mechatronic systems and objects	Based on the results of numerical simulations of modelled mechanical and mechatronic systems, the student is able to analyze and evaluate the designed system.	[SW3] Assessment of knowledge contained in written work and projects
[K6_W10] has a basic knowledge about development trends in terms of engineering and technical sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering, adequate for Mechatronics curse	The student expands his/her knowledge of new tools and methods used in mechanics, mechatronics and technical sciences.	[SW1] Assessment of factual knowledge
[K6_U05] is able to use properly choosen tools to compare design solutions of elements and mechatronics systems according to given application and economic crtierions (e.g. power demand, speed, costs)	The student knows modern methods of modeling mechanical and mechatronic systems and is able to apply them to solve a specific design problem.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents

Introduction to modeling of dynamical systems. Basic notion and terms - physical model, mathematical model, numerical model. Ordinary differential equations in modeling and analysis of dynamic systems. Analytical and numerical methods of solving ordinary differential equations on computational examples. Partial differential equations in modeling and analysis of physical systems. Application of distributed transfer function method in analysis of mechatronic systems. Computational examples of applications analytical and numerical methods to solving partial differential equations. Finite difference method. Finite volume method. Finite element method.

Prerequisites and co-requisites

Mathematics including linear algebra, matrix algebra, differential and integral calculus, linear ordinary and partial differential equations. Strength of materials including the theory of elasticity.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture	56.0%	50.0%
Laboratory	56.0%	50.0%

Recommended reading	Basic literature	1. Rao S.S.: The finite element method in engineering, Elsevier 2005. 2. Rakowski G., Kacprzyk Z.: Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005. 3. Gołębiowski L., Kulig T.S.: Metody numeryczne w technice, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2012. 4. Pietrzak J., Rakowski G., Wrześniowski K.: Macierzowa analiza konstrukcji, PWN 1989. 5. Gawroński W. i inni: Metoda elementów skończonych w dynamice konstrukcji, Arkady, Warszawa 1984. 6. Kruszewski J., Sawaik S., Wittbrodt E.: Metoda sztywnych elementów skończonych w dynamice konstrukcji,WNT 1999.
	Supplementary literature	Zienkiewicz O.C, Taylor R.L., Zhu J.Z.:The Finite Element Method: Its Basis and Fundamentals, Elsevier 2013.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Model a given mechanical system using the central difference method. 2. Using the finite element method, develop a mathematical model of the selected mechanical system. 3. Using hybrid modal modeling methods, model a given mechatronic system.	
Work placement	Not applicable	

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