GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Methods of monitoring dynamic processes , PG_00042733						
Field of study	Mechatronics						
Date of commencement of studies	February 2024		Academic year of realisation of subject	2024/2025			
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Zakład Mechatroniki -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Krzysztof Kaliński				
	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	Deepening selected elements of discrete mathematics, optimization, numerical and measurement methods; theoretically based general knowledge of mechatronic design; detailed theoretical knowledge about methods of supervising dynamic processes; knowledge of development trends and achievements in modern mechatronics.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U04] is able to utilise known methods and mathematical models, as well as computer simulations for analysis and evaluation of non-stationary continuous and discrete mechatronic systems and processes	The student recognizes the tasks of supervising dynamic processes targeted at various solutions.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K7_W06] has detailed, supported by the theory knowledge in terms of mechatronic design, mechatronic systems and machines, devices and process where they are used	The student recognizes dedicated methods for supervising dynamic processes and uses them in mechatronic design issues, taking into account at the same time non-technical aspects .	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K7_W01] has extended knowledge in terms of selected areas of mathematics, including discrete and applied mathematics, optimisation methods, mathematical and numerical methods essential for: 1) modelling and analysis of nonstationary mechatronics, continuous and discrete time systems as well as physical phenomena; 2) description and analysis of mechatronic systems that include programmable devices 3) description and analysis of signal processing algorithms 4) synthesis of non-stationary mechatronic systems	The student expands and deepens knowledge in selected areas of dynamic process supervision	[SW3] Assessment of knowledge contained in written work and projects
[K7_W10] knows development trends and most important new achievements in technical sciences and science disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering and related: Informatics and Materials Engineering	The student recognizes development trends and explores the most important new achievements in the field of supervising dynamic processes in stationary and mobile robotics, as well as in modern mechanical processing.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

LECTURE
1. Supervision - basic information.
2. Modeling of controlled mechatronic systems by mixed finite element method. Stationary systems. Linear non-
stationary systems. Nonlinear systems.
3. Optimal control at energy performance index. Linear, non-stationary control with continuous and discrete operation.
Control in a nonlinear system.
4. Supervising the movement of a 2-wheel mobile platform using optimal control at energy performance index.
5. Supervision of vibrations of carrying systems of industrial robots with the use of optimal control at energy
performance index.
6. Vibration monitoring during high speed milling with slender tools using variable spindle speed.
LABORATORY
During the course, students carry out practical classes on methods for creating and solving computational models of discrete mechatronic systems, optimal control at energy performance index in stationary and non-stationary linear systems, and in non-linear systems. Supervision methods are tested in the application of wheeled mobile platforms and selected mechanical processing operations.The tasks performed are dominated by elements of mechanics, automation and control. Requires virtual prototyping technique. Appropriate software (e.g. Matlab, Visual C, own packages) is recommended by the teacher.

Prerequisites and co-requisites

Knowledge of the subject Control theory (1st degree).
Knowledge and skills in Computer Science (1st degree).
Knowledge and skills in the subject: Modeling of mechatronic systems (1st degree)
Knowledge and skills in the subject of Mechatronic Design (1st degree).
Knowledge and skills in the subject: Manipulators and industrial robots (1st degree).
Knowledge and skills in the subject "Mechatronic design techniques" (2nd degree).

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory reports	100.0%	40.0%
Final colloquium	50.0%	60.0%

Recommended reading	Basic literature	1. Kaliński K. J .: Supervision of dynamic processes in mechanical systems. Gdańsk: Gdańsk University of Technology Publishing House 2012. 2. Kaliński K .: Supervision of vibration of discretely modeled mechanical systems. Series Monographs No. 22. Gdańsk: Gdansk University of Technology Publishing House 2001. 3. Galewski M., Kaliński K .: Supervision of vibrations during speed milling with slender tools with variable speed. Gdańsk: Gdańsk University of Technology Publishing House 2009.
	Supplementary literature	1. Mechatronic design. Selected issues. (Edited by T. Uhl). Krakow: The Chair of Robotics and Mechatronics AGH, every year since 2006. 2. Selected issues of modal analysis of mechanical structures. (Edited by T. Uhl). Krakow: The Chair of Robotics and Mechatronics AGH, every year since 2005. 3. Design and dynamics of mechatronic devices. Ed. M. Mańka and K. Mendrok. Kraków: The Chair of Robotics and Mechatronics AGH 2019. 4. Lisowski W .: Selected problems of automation of experimental modal analysis. AGH University of Science and Education. Krakow 2006. Dissertations Monographs 158. 5. Giergiel M. J., Hendzel Z., Żylski W .: Modeling and control of mobile wheeled robots. Warsaw: Polish Scientific Publishers PWN 2002. 6. Articles from scientific and technical journals (recommended on an ongoing basis)
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Modeling of variable systems during configuration. Sliding and turning kinematic pairs. 2. Optimal control at energy performance index in a non-stationary linear system with discrete operation. Mathematical description in state coordinates. 3. Supervising the movement of a 2-wheeled mobile platform. Platform dynamics. 4. Supervision of vibrations of carrying systems of industrial robots. Identification of modal model parameters. 5. Tool-workpiece vibration supervision. Optimal spindle speed control.	
Work placement	Not applicable	

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