GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Control Theory , PG_00055448		
Field of study	Mechatronics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	5	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Mechanics and Mechatronics -> 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	15.0	15.0	0.0	0.0	45
	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	45	6.0	49.0	100

Subject objectives	Presentation of the state variable method in an application to modelling of dynamic systems. Introducing the method of designing feedback control systems. Acquainting with the methods of state variables reconstruction by using a full and reduced order observer. Getting practical skills in designing, synthesis and analysis of multidimensional feedback control systems.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] has knowledge in the field of mathematics that include vector and matrix calculus, analytical geometry, mathematical analysis (including ordinary and partial differential equations) and elements of discrete and applied mathematics, including mathematical and numerical methods essential to: 1) description and analysis od stationary, continuous and discrete mechatronics systems as well as basic physical phenomena that occur there; 2) description and analysis od programmable mechatronic systems; 3) description and analysis for signal processing; 4) synthesis of mechatronics elements and systems	Student mastered the mathematical methods and tools necessary to design and analysis one as well as multidimensional control systems. He can apply the method of state variables to design control systems with a controller and state observer.	[SW1] Assessment of factual knowledge
	[K6_W03] has organized and theoretically supported, advanced knowledge in the field of automation and control theory of stationary , continuous and discrete mechatronic systems, mechatronic design, developments and exploitation of mechatronic systems	Student has knowledge about modeling and designing of one dimensional, feedback control systems with single input and single output (SISO) as well as multidimensional feedback control systems with multiple inputs and multiple outputs (MIMO).	[SW1] Assessment of factual knowledge
	[K6_U02] is able to elaborate on specific mechatronic topics as well as topics from engineering and technology sciences and disciplines such as Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies	Can design one and multidimensional control systems using the state space method.	[SU1] Assessment of task fulfilment
	[K6_W10] has knowledge about development trends in the field of engineering and technology sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies, adequate for Mechatronics curse	He knows the trends in the development of theoretical methods as well as practical technologies used in automation and control theory.	[SW1] Assessment of factual knowledge

Subject contents	Modeling of dynamic systems using the state variables method. Converting state-space model to transfer function. Converting transfer function to state-space model. Diagonalization and uncoupling of the state-space equations. Eigenvalues and eigenvectors. Controllability and observability. State variable feedback controller. Observer. Solving state-space equations.
Prerequisites and co-requisites	Required knowledge of linear algebra including operations on matrices and vectors as well as problems related to solving systems of linear equations and inequalities.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	56.0%	20.0%
Exercises	56.0%	40.0%
Lecture	56.0%	40.0%

Recommended reading	Basic literature	1. Kaczorek T.: Teoria układów regulacji automatycznej, WNT, Warszawa 1977, 2. Kaczorek T.: Teoria sterowania, Tom 1, Układy liniowe, ciągłe i dyskretne, PWN, Warszawa 1977, 3. Kaczorek T.: Teoria sterowania, Tom 2, Układy nieliniowe, procesy stochastyczne oraz optymalizacja statyczna i dynamiczna, PWN Warszawa 1981, 4. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium Tom 1, Gdańsk 1999, 5. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium Tom 2, Gdańsk 2008, 6. Amborski K., Marusak A.: Teoria sterowania w ćwiczeniach, PWN, Warszawa 1978, 7. Nagrath I.J, Gopal M.: Control Systems Engineering, Anshan LTD 2008.
	Supplementary literature	1. Kaczorek T.: Teoria wielowymiarowych układów dynamicznych liniowych. WNT Warszawa 1983.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Determine the state space equations for a given control system 2. Determine the transfer function based on the given state space equations 3. Determine the state space equations based on the given transfer function 4. Determine the controller coefficients in the state variable feedback for given time response properties or given frequency response properties 5. Determine the state observer coefficients for a given time response properties or given frequency response properties 6. Determine the solution of the state equations by using a specified method	
Work placement	Not applicable	

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