



Subject card

Subject name and code	Control System Design, PG_00064794						
Field of study	Mechatronics						
Date of commencement of studies	February 2025	Academic year of realisation of subject			2025/2026		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			exam		
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	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	4.0		16.0		50
Subject objectives	The main aim of the course is to provide students the knowledge necessary to design continuous time control systems. During the course students learn the methods of selecting and designing controllers based on the time, frequency and integral performance indices. They get the skills of designing and application a such compensators as lead, lag and lead-lag to correcting dynamic properties of control systems. Course participants will get also general knowledge about root locus technique and its applications to control system design.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W03] demonstrates structured and theory supported knowledge encompassing key issues in the field of Mechatronics, enabling development and synthesis of stationary and non-stationary mechatronic systems, devices, and processes with continuous and discrete operation	Student possesses knowledge about the 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		
	[K7_U02] formulates and tests hypotheses concerning problems of stationary and non-stationary mechatronic systems/processes, as well as simple research problems	Student can apply the acquired theoretical knowledge to formulate and solve practical problems of controlling real mechatronic systems.			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
	[K7_U01] utilizes acquired analytical, simulation, and experimental methods, as well as mathematical models for analysis and evaluation of stationary and non-stationary mechatronic systems/processes with continuous and discrete operation	Student uses learned methods to model control processes of mechatronic systems. Can apply computer programs to analyze, model, and simulate control systems.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
Subject contents	Designing of continuous controllers based on the time, frequency and integral performance indices. Designing of state feedback optimal controller. Designing of lead, lag and lead-lag compensators. Designing of typical controllers by using the root locus technique.						

Prerequisites and co-requisites	Mathematics at the academic level, Fundamentals of control engineering		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture	50.0%	40.0%
	Laboratory	50.0%	60.0%
Recommended reading	Basic literature	<p>1. Nagrath I.J, Gopal M.: Control Systems Engineering, Anshan LTD 2008,</p> <p>2. Dukkupati R.V. : Analysis and design of control systems using Matlab, New Age Science, 2nd edition 200,</p> <p>3. Kaczorek T.: Teoria układów regulacji automatycznej, WNT, Warszawa 1977,</p> <p>4. Kaczorek T.: Teoria sterowania, Tom 1, Układy liniowe, ciągłe i dyskretne, PWN, Warszawa 1977,</p> <p>5. Kaczorek T.: Teoria sterowania, Tom 2, Układy nieliniowe, procesy stochastyczne oraz optymalizacja statyczna i dynamiczna, PWN Warszawa 1981,</p> <p>6. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium Tom 1, Gdańsk 1999,</p> <p>7. Amborski K., Marusak A.: Teoria sterowania w ćwiczeniach, PWN, Warszawa 1978.</p> <p>8. Mazurek J., Vogt H., Żydanowicz W.: Podstawy automatyki, OWPW, Warszawa 2006,</p> <p>9. Holejko D., Kościelny W.,J.: Automatyka procesów ciągłych, OWPW, Warszawa2012</p> <p>10. Próchnicki W., Dzida M.: Podstawy automatyki. Zbiór zadań, WPG, Gdańsk 2004</p>	
	Supplementary literature	1. Douglas B.: The fundamentals of control theory	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<p>1 For a given control system, select the appropriate type of controller and determine its settings based on the given time criteria of regulation (steady state errors, rise time, settling time, overshoot)</p> <p>2. For a given control system, select the appropriate type of controller and determine its settings based on the given frequency criteria (bandwidth, amplitude margin, phase margin, dimensionless damping coefficient, natural frequency vibrations)</p> <p>3. For a given control system, select the coefficients of the optimal controller based on the given integral criteria.</p> <p>4. Select appropriate compensators: phase lag, phase lead and phase lead-lag, so that the systems with compensators have an appropriate stability margin (amplitude or phase) and specified static or dynamic properties of regulation.</p>		
Work placement	Not applicable		

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