GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Control Engineering II, PG_00053201		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Intelligent and Decision Support Systems -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Rafał Łangowski	
	Teachers	dr inż. Rafał Łangowski dr inż. Tomasz Zubowicz mgr inż. Mateusz Czyżniewski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	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	1.0	19.0	50

Subject objectives	The aim of the course is for the student to acquire knowledge of modelling low-order dynamic plants, analysing their properties and designing control systems for these plants.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U07] can build and analyze models of systems and systems in the field related to control systems and automation	Derives the first principle dynamic models of the low complexity systems such as R, L, C electrical circuits, DC electrical motors, heat transfer and fluid flow systems. Analyses properties of single input - single output (SISO) linear time invariant dynamic systems based on zeros and poles nad to analytically calculate their responses to typical input signals. Investigates stability of SISO systems based on the poles by applying the algebraic Routh-Hurwitz criterion. Investigates stability of feedback systems by applying the frequency domain based Nyquist stability criterion. Assesses stability robustness of feedback systems based on the open loop system phase and gain margins.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W07] has basic knowledge related to control and automation systems	Explains the structures and properties of the PID family of controllers. Selects their parameters by analytical methods and by experimental Ziegler - Nichols methods for low order plants. Explains the structure with state feedback for low-order plants. Designs basic control systems satisfying quality requirements in the time domain using the pole placement method.	[SW1] Assessment of factual knowledge

Subject contents

The course is carried out as 10 three-hour laboratory sessions with the following schedule. 1. Basic operations on numbers and matrices in the MATLAB environment. 2. MATLAB - instructions, external functions and graphics. Introduction to the Control System Toolbox. 3. Introduction to the SIMULINK package in the MATLAB environment. 4. Time domain analysis for elementary automation plants. 5. Frequency analysis for elementary automation plants. 6. Static and dynamic properties of control systems - part I. 7. Static and dynamic properties of control systems - part II. 8. PID control systems - part I. 9. PID control systems - part II. 10. PID control of the DC motor.

Prerequisites and co-requisites

Fundamentals of linear time invariant and scalar differential equations, Laplace transforms, complex numbers and matrix algebra. Moreover, the basic knowlegde of signal processing and sensors and actuators. The Pre-Requisites: Information Technology, Metrology, Computer Networks and Internet Technology, Electronics (term 2), Basic of Digital Technology, Fundamentals of Control Engineering I (semester 3), Matrix Algebra, Automation Equipment.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
realisation level of laboratory tasks	50.0%	100.0%

Recommended reading

Basic literature

1. Dorf C.D., Bishop R. H.: Modern control systems. Eleventh Edition. Pearson Prentice Hall, Upper Saddle River, NI 07458, 2008.
2. Kaczorek T.: Teoria układów regulacji automatycznej. Wydawnictwa Naukowo-Techniczne, Warszawa, 1974.
3. Kabziński J.: Teoria sterowania Projektowanie układów regulacji. Wydawnictwo Naukowe PWN, Warszawa, 2021.
4. Ogata K.: Modern Control Engineering. Fifth Edition. Pearson Prentice Hall, Upper Saddle River, NI 07458, 2010.
5. Brzózka J., Dorobczyński L.: Matlab: środowisko obliczeń naukowo-technicznych. Wydawnictwo Mikom, Warszawa, 2005.

Supplementary literature

1. Franklin G.E., Powell J.D., Emami-Naeini E.: Feedback Control of Dynamic Systems. Addison Wesley Publishing Company, 1994.
2. Mitkowski W.: Zarys teorii sterowania. Wydawnictwa AGH, Kraków, 2019.

	eResources addresses	Podstawowe https://www.mathworks.com/ - Matlab/Simulink website. Adresy na platformie eNauczanie: Podstawy inżynierii sterowania II [2024/25] - Moodle ID: 42947 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42947
Example issues/ example questions/ tasks being completed	• 1) Analysis of plants properties; • 2) Linearity and nonlinearty; • 3) Hurwitz, Routh and Nyquist stabiluity criteria; • 4) PID controller design;	
Work placement	Not applicable	

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