GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Automation and Control, PG_00055387		
Field of study	Mechanical Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	5.0
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	dr hab. inż. Rafał Hein	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	15.0	0.0	0.0	60

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	60	5.0	60.0	125

Subject objectives

Presentation of the fundamental issues related to automatic control systems. Knowing the structure and components of a typical control system. Gaining general information about the methods of designing, analysis and study of the properties of typical control systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] is able to identify, formulate and develop the documentation of a simple design or technological task, including the description of the results of this task in Polish or in a foreign language and to present the results using computer software or other aiding tools	Student is able to build, design and analyze basic automatic control systems with the typical, universal industrial controllers.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W06] possesses elementary knowledge on automatics and robotics of mechanical systems	Student knows the structure of a typical automation system and its components	[SW1] Assessment of factual knowledge

Subject contents

Lectures

Introduction. Control system structure. Classification of control elements. Block diagrams and block diagram algebra. Classification of control systems. Open and closed loop feedback control systems. Properties of the feedback control systems. Mathematical description of signals and control systems. Laplace transformation and its application. The concept of transfer function. Static characteristics of automation systems. Dynamic time characteristics. Determination of step and impulse responses. Frequency analysis. Dynamic frequency characteristics. Drawing Nyquist and Bode charts. Basic components of control systems. Classification, description, characteristics and examples of typical control system components: proportional, integral, derivative, delay, first and second order systems. Controllers. PID controller - construction, structure, characteristics. Concept of stability. Stability of control systems. Conditions for stability. Algebraic (Hurwitz, Routh) and graphic (Nyquist) criteria of stability. Stability margin.

Tutorials

Application of the Laplace transform in solving differential equations. Signals description in the time domain and determination of their Laplace transform. Determination of transfer function for systems with different physical nature. Rules and block diagram reduction. Determination of time responses of systems with a given transfer function. Preparation of frequency characteristics of Bode and Nyquist. Research on the stability of control systems based on algebraic (Hurwitz, Routh) and graphical (Nyquist) criteria. Determining of stability marigin. Choice of the type and parameters of the controller . Designing and analysis of simple continuous control systems.

Labs

Design and analysis of combinational logic systems. Simulation and analysis of control systems in the Matlab & Simulink package. Determination of static and dynamic (time and frequency) characteristics of selected physical systems. Investigation of temperature control system with PID controller. Investigation of electromechanical servomechanism.

Prerequisites and co-requisites

Mathematics, Physics, Mechanics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory (reports from laboratory exercises)	56.0%	30.0%
Midterm colloquium	56.0%	30.0%
Written exam	56.0%	40.0%

Recommended reading

Basic literature

1. Holejko D., Kościelny W., J.: Automatyka procesów ciągłych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012,

2. Mazurek J., Vogt H., Żydanowicz W.: Podstawy Automatyki, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006,

3. Perycz S.: Podstawy automatyki. Skrypt PG. Gdańsk 1983,

4. Żelazny M.: Podstawy automatyki, PWN, Warszawa 1976,

5. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium t.1, Gdańsk 1999.

6. Orlikowski C., Wittbrodt E.: Podstawy automatyki i sterowania. Laboratorium t.2, Gdańsk 2007.

7. Próchnicki W., Dzida M.: Podstawy automatyki. Zbiór zadań. Wyd. PG. Gdańsk 2004.

Supplementary literature

1. Kaczorek T.: Teoria układów regulacji automatycznej. WNT Warszawa 1974,

2. Morecki A., Knapczyk J.: Podstawy robotyki. Teoria i elementy manipulatorów i robotów. WNT. Warszawa 1993.

	eResources addresses	Adresy na platformie eNauczanie: Automatyka i Sterowanie 2022/2023 - Moodle ID: 30206 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30206
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	