GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Control System Structures, PG_00038290		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Electric Drives and Energy Conversion -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Adamowicz	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	10.0	0.0	10.0	0.0	0.0	20

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	20	9.0	71.0	100

Subject objectives

The goal of the course is for the student to master knowledge related to control system structures for various types of controlled objects. The student will learn the principles of selecting an appropriate control system structure for a given controlled object. Additionally, the student will acquire knowledge on defining control objectives and quality requirements, as well as knowledge related to the design and modeling of control systems and the examination of their characteristics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W14] has knowledge of mathematical modelling, identification, optimisation, decision suport decision-making and control, knows methods of implementing advanced control algorithms in industrial equipment	Is able to build a model of a given control object in the form of a transfer function or a system of differential equations and build a simulation model and implement a given structure of a complex control system, taking into account constraints and parametric uncertainty.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_K06] is aware of the impact of engineering activities on the quality of applied solutions and the environment	Is able to assess the quality of the control system, fulfillment of requirements and possibilities of implementation on a physical object based on acquired theoretical knowledge and simulation studies.	[SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Course content – lecture

LECTURES: Feed-forward control. Cascade control system with trajectory generator and disturbance compensation. Control of objects with delay (Smith predictor). Control with state feedback. Vibration damping methods. Adaptive control (MRAS). Sliding control of a nonlinear object. Nonlinear control, nonlinear transformation of variables and linearization by feedback. Modal control.

Course content – laboratory

LABORATORY: Elimination of vibrations in systems with weak damping using an input filter (Input Shaping Filter). Control system with state feedback. Application of Smith predictor to control an object with delay. Adaptive control system with reference model (MRAS, MRAC). Study of cascade control system on the example of a servo. Robust servo control using sliding control.

Prerequisites and co-requisites	Basic knowledge of control theory, metrology, microprocessor technology, matematics.	
Assessment methods and criteria	see table below	
Recommended reading	Basic literature	1. Kaczorek T., Dzieliński, Dąbrowski, Łopatka: Podstawy teorii sterowania,PWN 2009. 2. Tatjewski P.: Sterowanie zaawansowane obiektów przemysłowych. Struktury i Algorytmy. Warszawa. 3. Bubnicki: Teoria i algorytmy sterowania, PWN, 2005.
	Supplementary literature	1. Åström, Wittenmark , H. Butler, Model-Reference Adaptive Control- From Theory to Practice, Prentice-Hall, 1992, 2. Bodgan Wilamowski; J. David Irwin: Control and mechatronics, CRC Press, Taylor&Francis Group, 2011. 3. Bogdan M. Wilamowski; J. David Irwin: Intelligent systems, CRC Press, Taylor&Francis Group, 2011. 4. Brok S.: Struktury odpornego sterowania elektrycznego napędu bezpośredniego z wykorzystaniem koncepcji sterowania ślizgowego, Politechnika Poznańska, Rozprawy nr 497, Poznań, 2013 5. Ellis G.: Comparison of position control for industrial Applications, Danaher Motion, 2002. 6. Franklin G., Powell J. D., Emami-Naeini A.: Feedback Control of Dynamic Systems, Prentice Hall, 4 edition, 2002 7. Malek. K, Makys P., Sturlajter M.: Feed Forward Control of Electrical Drives Rules and Limits, Power Engineering and Electrical Engineering, vol.9, no 1/2011.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Explain the control system structure based on MRAS method, 2 . Applications of the sliding control method. 3. How is the open loop control system based on "input shaping" designed	
Practical activites within the subject	Not applicable	

Assessment methods and criteria:

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory reports	60.0%	50.0%
Exam	50.0%	50.0%

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