GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Dynamic Systems, PG_00038123		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Optional subject group 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	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Wojciech Śleszyński	
	Teachers	dr inż. Wojciech Śleszyński	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	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	3.0	17.0	50

Subject objectives

The objective of the course is for the student to acquire knowledge and skills in the processing of continuous-time and discrete-time signals.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U08	Student uses discrete Fourier transform (DFT) for the analysis of discrete-time and sampled continuous-time signals. Student is able to assess the dynamic properties of analog and digital systems based on the digital simulation. Implements and uses simple digital filters. Student knows CAD methods for the design and analysis of digital filters.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
K6_W10	Students is able to use analytical and simulation-based methods to formulate and solve tasks in the field of continuous-time and discrete-time signal processing. Student formulates mathematical description of continuous-time and discrete-time dynamic systems in the time and frequency domains. Explains the relationship between the impulse response, the transfer function and the frequency response of a dynamic system. Student explains and uses basic methods of digital filter design.	[SW1] Assessment of factual knowledge

Subject contents

LECTURE Continuous-time and discrete-time signals. Sampling, sampling theorem. Fourier series and Fourier transform of continuous-time and discrete-time signals. Discrete Fourier transform. Linearity, causality and time invariance. Description of linear dynamic systems, continuous-time and discrete-time: differential and difference equations, Laplace transform, Z transform, impulse response, convolutions, transfer function, frequency response, block diagrams. Zero-state and zero-input response. Stability. Transmission of signals through linear systems. Basic types and structures of digital filters. Digital filter design by analog prototyping. TUTORIALS Fourier series. Using discrete Fourier transform (DFT) for the analysis of selected continuous-time signals (square wave, sawtooth etc.). Impulse response, convolutions, analysis of discrete-time systems in Matlab environment. Design, implementation and testing of selected digital filters. Implementation and analysis of the phase-locked loop (PLL) algorithm.

Prerequisites and co-requisites		
Assessment methods and criteria		

Subject passing criteria	Passing threshold	Percentage of the final grade
Test of lecture-related knowledge	50.0%	55.0%
Exercise reports	50.0%	45.0%

Recommended reading	Basic literature	1. Śleszyński W.: Sygnały i systemy dynamiczne. Politechnika Gdańska, WEiA, Gdańsk 2010. 2. Wojciechowski J. M.: *Sygnały i systemy*. WKŁ, Warszawa 2008. 3. Zieliński T.P.: Cyfrowe przetwarzanie sygnałów. WKŁ, Warszawa 2007. 4. Oppenheim A. V., Willsky A. S., Nawab S. H.: *Signal and Systems*. Prentice-Hall, 1997. 5. Chen C.-T.: *System and Signal Analysis*. Saunders College Publishing, 1994.
	Supplementary literature	1. Gabel R., Roberts R. A.: Signals and Linear Systems. Wiley, 1991. 2. Lyons R. G.: Understanding Digital Signal Processing. Pearson, 2011. 3. Oppenheim A. V., Schafer R. W.: Discrete-Time Signal Processing. Pearson, 2010. 4. Franklin G. F., Workman M. L., Powell D.: *Digital Control of Dynamic Systems*. Addison-Wesley, 1998.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. A periodic sequence of period N is made of the following samples (per period): 4, 2, 0, 3, 0, -3, 2, 0. Find the Fourier series coefficient c_2. 2. Draw a block schematic of the discrete-time system defined by a given transfer function. 3. Find the difference equation of the dynamic system defined by a given transfer function. Compute the first 6 samples of the response of the system to a given input sequence. 4. Find the difference equation an transfer function of the filter defined by a given block schematic. Compute the filter gain for selected frequencies. 5. Using the "Euler backward" method ($s = (1 - 1/z) / T$), digitize the PI controller with the following transmittance: R(s) = Kp + Ki / s. Give the differential equation of the controller. Calculate the steady-state value of the impulse response and the starting value of the step response.	
Work placement	Not applicable	