GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Signal Processing - laboratory, PG_00048811						
Field of study	Electronics and Telecommunications						
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 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	1.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Multimedia Systems -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Daniel Węsierski					
	Teachers	dr inż. Daniel Węsierski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	15.0	0.0	0.0	15
	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	15		1.0	9.0		25
Subject objectives	Student uses MATLAB tools for implementation of discrete-time signal processing algorithms, and their application to the analysis of signals and systems in the time and frequency domains (FFT), and to designing elementary discrete-time systems.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	- student uses MATLAB tools to implement discrete-time signal processing algorithms - student analyzes signals and systems in the domains of time and frequency (FFT) - student designs algorithms for basic discrete-time signal processing systems	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n	- student uses MATLAB tools to implement discrete-time signal processing algorithms - student analyzes signals and systems in the domains of time and frequency (FFT) - student designs algorithms for basic discrete-time signal processing systems	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
[K6_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	- student uses MATLAB tools to implement discrete-time signal processing algorithms	[SU5] Assessment of ability to present the results of task
[K6_U07] can apply methods of process and function support, specific to the field of study	- student uses MATLAB tools to implement discrete-time signal processing algorithms	[SU5] Assessment of ability to present the results of task

Subject contents

Visualization of typical signals, including modulated signals, and listening them in on ear-phones. Spectrogram. Sampling and reconstruction of signals. DTFT, DFT and FFT, and their properties. Spectral analysis usig the FFT and windows. Quantization of continuous-time (analogue) signals. Linear and circular convolutions, and their application to obtaining the linear discrete-time system response for given excitation. Basic discrete-time systems, their characteristics and examples of applications. Zeros and poles of digital filter transfer function. Shaping the frequency response based on zeros and poles.

Prerequisites and co-requisites

Passed exam on Signal Processing from semester 3

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	51.0%	100.0%

Recommended reading

Basic literature	1. Allan V. Oppenheim, Ronald W. Schafer "Discrete-Time Signal Processing - Third Ediction", Prentice-Hall Signal Processing Series, 2014 2. T.P. Zieliński "Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań", WKŁ Warszawa 2005. 3. Laboratory instructions with theoretical issues.
Supplementary literature	Presentations connected with Signal Processing lectures.
eResources addresses	Adresy na platformie eNauczanie: Przetwarzanie sygnałów - laboratorium 2024/2025 - Moodle ID: 44633 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=44633

Example issues/ example questions/ tasks being completed

1. Choose any differential equation of the DLS system with non-zero initial conditions and causal stimulation (similar to the section with examples, it can be, for example, an equation from an exam task or test). Analyze the system in the time domain similar to the sections with examples (block diagram, computational complexity of the algorithm, system responses).
2. Select a bi-harmonic signal (or with more than two components) for testing that meets the sampling theorem similar to the section with examples. Record this signal as an example. Compare, discuss the results of the tests for three reconstructors (use the PROREK graphic interface, draw signals and spectra).
3. Select a system with known transmittance and impulse response for testing. Conduct your research by choosing the right input signals and discuss the results as in the section with examples (frequency and time characteristics, distribution of zeros and poles, stability, response as a convolution).
4. Investigate the phenomenon of spectrum leakage similar to the section with examples. Select real or complex sine wave for testing. Adjust the frequency f0 and parameter N once so that the phenomenon of spectrum leakage does not occur and once so that the phenomenon of spectrum leakage occurs. Make appropriate drawings of signals and spectra and discuss the results obtained.

Work placement

Not applicable

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