GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Signal Processing - laboratory, PG_00047791		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
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_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	- 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	[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment
[K6_W04] knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	- 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	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

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

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Practical exercise</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>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. Instrukcje laboratoryjne zawierające opracowania teoretyczne zagadnień.</td></tr>
<tr><td>Supplementary literature</td><td>Presentations connected with Signal Processing lectures.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">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.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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