GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Signal and image processing, PG_00064792		
Field of study	Mechatronics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
Education level	second-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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Metrology and Electronic Systems Department -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Strąkowski	
	Teachers	dr inż. Marcin Strąkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	0.0	45

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	45	8.0	22.0	75

Subject objectives

Gain knowledge in the field of advanced methods of processing and analysis of digital signals and images.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W04] demonstrates knowledge encompassing selected issues in the field of detailed knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Mechatronics	Has expertise in designing and implementing advanced digital signal and image processing systems. Is familiar with contemporary methods and tools for advanced signal and image processing, including denoising and adaptive filtering.	[SW1] Assessment of factual knowledge
[K7_U02] formulates and tests hypotheses concerning problems od stationary and non-stationary mechatronic systems/processes, as well as simple research problems	Able to select appropriate methods for signal and image processing and test them to solve simple research problems.	[SU1] Assessment of task fulfilment
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	Possesses knowledge of modern signal and image processing techniques, and can select appropriate methods and algorithms for complex tasks in signal and image acquisition and analysis in mechatronics.	[SU1] Assessment of task fulfilment

Subject contents

Course content – lecture

Digital signal and image filtering topics (including non-uniform sampling), spectral analysis and power spectral density estimation, higher-order spectra, Wiener and Kalman filters, linear and nonlinear adaptive filtering, time-frequency analysis (STFT, wavelet), signal denoising methods, regression and detection methods using PCA and SVM algorithms, advanced image processing methods, image processing in measurement applications, vision (stereoscopic) measurement systems, and the use of image processing in machine learning.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Knowledge of basic concepts in digital signal and image processing. Knowledge of the basics of discrete mathematics.

It is recommended to complete the course "Fundamentals of Digital Signal Processing."</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Tests during semester</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Completion of all laboratory exercises</td><td>50.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. Haykin S.: Adaptive filter theory. Prentice Hall, 2001.
2. Zieliński T.P.: Cyfrowe przetwarzanie sygnałów. WKiŁ, Warszawa 2005.
3. Vaseghi S.V.: Advanced Digital Signal Processing. Wiley 2009.
4. W. Malina, M. Smiatacz, Cyfrowe przetwarzanie obrazów. Akademicka Oficyna Wydawnicza EXIT, Warszawa 2008</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1. Bilinskis I.: Digital alias2free signal processing. Wiley 2007.
2. Haykin S.: Adaptive filter theory. Prentice Hall, 2001.
3. Kuo S.M., Gan W.S.: Digital signal processors 2 architectures, implementations and applications. Prentice Hall, 2005.
4. Chassaing R.: Digital signal processing and applications with the C6713 and C6416 DSK. Wiley 2005.
5. M. Seul, L. O'Gorman and M. Sammon, Practical Algorithms for Image Processing, Cambridge University Press, USA, 2000.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. Signal sampling
2. Parametric and non-parametric spectral analysis
3. Filtration according to Wiener and Kalman
4. Time-frequency analysis methods
5. Mono- and stereovision 3D scanners</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="3">Not applicable</td></tr>
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