GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Adaptive Filtration, PG_00068080		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Signals and Systems -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Piotr Kaczmarek	
	Teachers	dr inż. Piotr Kaczmarek	

Lesson types

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

The aim of the course is to understand the fundamentals of adaptive filter operation and to acquire practical skills in applying them to engineering problems. The course introduces basic concepts related to adaptive signal processing methods. Students will learn classical adaptive filtering algorithms such as LMS (Least Mean Squares) and RLS (Recursive Least Squares), along with their applications in noise reduction, system modeling, and signal detection. The lectures cover the theory of adaptive filters, convergence analysis, and fundamental engineering applications.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	The student can design adaptive filtering algorithms for applications in various industrial sectors.	[SU1] Assessment of task fulfilment
[K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	The student is familiar with function extremum search methods to the extent necessary for their application in adaptive filtering based on the least squares method.	[SW1] Assessment of factual knowledge
[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student can design basic algorithms based on adaptive filtering and adaptive signal processing.	[SU1] Assessment of task fulfilment
[K6_W21] knows and understands the basic methods of decision making as well as methods and techniques of design and operation of automatic regulation and control systems, computer applications for controlling and monitoring dynamic systems.	The student can apply basic adaptive filtering algorithms to process monitoring.	[SW1] Assessment of factual knowledge

Subject contents

Course content – project
Introduction to Adaptive Filtering
Mathematical Foundations of Filtering
Mean Squared Error (MSE) Criterion
LMS Algorithm Basics
Properties of LMS
Variants of LMS
RLS Algorithm Basics
Properties of RLS
Applications Noise Reduction and Echo Cancellation
Applications System Modeling and Identification
Applications Adaptive Filters in Industry
IIR vs. FIR Filters in the Context of Adaptation
Elements of Machine Learning in Adaptive Filters
Implementation and Numerical Issues

Prerequisites and co-requisites

The student should have knowledge in the following subjects: Numerical Methods & Optimization in Automatic Control, and Computational Algorithms.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	60.0%	100.0%

Recommended reading

Basic literature	Haykin, S. *Adaptive Filter Theory*, 5th Edition
Supplementary literature	Paulo S.R. Diniz *Adaptive Filtering: Algorithms and Practical Implementation*
eResources addresses	

Example issues/ example questions/ tasks being completed

Practical activites within the subject

Not applicable

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