



Subject card

Subject name and code	Adaptive Filtration, PG_00068080						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2027/2028		
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 -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Piotr Kaczmarek				
	Teachers		dr inż. Piotr Kaczmarek				
Lesson types and methods of instruction	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_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_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_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_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	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. <i>Adaptive Filter Theory</i> , 5th Edition	
	Supplementary literature	Paulo S.R. Diniz <i>Adaptive Filtering: Algorithms and Practical Implementation</i>	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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