Subject card

Subject name and code	Change Detection in Signals, PG_00064547		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group 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	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department Of Decision Systems And Robotics -> Faculty Of Electronics Telecommunications And Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Janusz Kozłowski	
	Teachers	dr inż. Janusz Kozłowski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	0.0	0.0	30
	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	30	4.0	16.0	50

Subject objectives	Assimilation of principles of mathematical modelling of dynamic systems. Expanding knowledge on parameter identification and change detection algorithms. Practical implementations of algorithms.

Learning outcomes	<table><tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr><tr><td>[K7_K02] is ready to provide critical evaluation of received content and to acknowledge the importance of knowledge in solving cognitive and practical problems</td><td>Student solved practical problems using expert knowledge on system identification and rationally compares different approaches.</td><td>[SK2] Assessment of progress of work</td></tr><tr><td>[K7_W03] knows and understands, to an increased 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</td><td>Student got practical knowledge on applications of the on-line detection and identification procedures. Student got familiar with analytical methods for examination of algorithms.</td><td>[SW1] Assessment of factual knowledge</td></tr><tr><td>[K7_U03] can design, according to required specifications, and make a complex 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</td><td>Student got practical knowledge on mathematical modelling of control systems, learned the identification methods of deterministic and stochastic models.</td><td>[SU4] Assessment of ability to use methods and tools</td></tr><tr><td>[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools</td><td>Student implemented modern procedures of parameter estimation and optimal filtering. Student also utilized familiar with methods used to improve accuracy of estimates of parameters.</td><td>[SU4] Assessment of ability to use methods and tools</td></tr></table>
Subject contents	Selected applications of detection methods. Deterministic and stochastic models. Linear integrating filters and Poisson moment functionals in discrete-time approximations of continuous systems. Estimation of process parameters and detection of parameter variations using parameter identification methods: properties of algorithms. Least-squares method: recursive and non-recursive algorithms. Instrumental-variable method, properties of the method and selection of instrumental variables. Tracking the evolution of process parameters with the aid of error weighting mechanism. Robust to measurement faults parameter identification algorithms derived from minimization of non-quadratic criteria. Applications of robust algorithms in diagnostics. Minimization of non-quadratic criteria: simplex method and recursively-iterative method. Direct method of continuous-time system identification. Identification of delay systems, systems with nonlinearities and distributed parameter systems.
Prerequisites and co-requisites	

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final test on theory. It is necessary to score at least 13 out of total amount of 25 pts. Time for the test: 60 minutes.	50.0%	100.0%
Recommended reading	Basic literature	Basseville M., Nikiforov I.V.: Detection of abrupt changes: theory and application. Prentice-Hall Inc., 1993. Ljung L.: System identification. Theory for the user. Prentice-Hall Inc., 1987. Korbicz J., Kościelny J.M., Kowalczuk Z., Cholewa W. (Editors): Fault diagnosis: models, artificial intelligence, applications. Springer, Berlin New York, 2004.	
	Supplementary literature	Anderson B.D.O., Moore J.B.: Optimal filtering. Information and System Sciences Series. Prentice-Hall Inc., 1979.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Specify in brief possible applications of change detection algorithms. Explain why abrupt changes do not necessarily mean changes large in magnitude. 2. Enumerate and describe in brief common performance indices used for evaluation of quality of change detection. 3. Compare the Kalman approach and the Wiener approach to optimal filtering. Indicate situations where Kalman filter demonstrates its supremacy. 4. Compare the so-called direct and indirect approaches to identification of continuous-time systems. Enumerate the benefits and drawbacks of both concepts. 5. Describe the direct method of identification of continuous-time systems based on the method of linear integral filtering (LIF). Introduce the transfer function of the LIF operator and derive the ultimate formula for the numerical LIF realization using the bilinear operator. Formulate and justify the rule of thumb for proper selection of the integration horizon.		
Work placement	Not applicable		