GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modelling and Identification, PG_00038189		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
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	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Grochowski	
	Teachers	mgr inż. Rafał Buler mgr inż. Jakub Buler dr hab. inż. Michał Grochowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	10.0	10.0	0.0	50

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	50	5.0	20.0	75

Subject objectives

Presentation of advanced modern methods of systems modeling and estimation of their parameters. Analytical, fuzzy and neural technology will be presented.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W14] has knowledge of mathematical modelling, identification, optimisation, decision suport decision-making and control, knows methods of implementing advanced control algorithms in industrial equipment	Models dynamic objects and control systems. Selects an appropriate method for modeling, identifying and verifying objects and control systems	[SW3] Assessment of knowledge contained in written work and projects
[K7_U06] is able to plan the preparation and execution of experiments, measurements and computer simulations to evaluate the performance of automation and robotics tasks	Student examines the behavior of dynamic objects by simulation and experiment; -Student selects the appropriate analytical and simulation methods to solve tasks in the field of control engineering and robotics; -Student formulate and solve optimization problems with the limits	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>Course content – lecture

LECTURE Repetytorium basis of modeling and identification, range of degree studies. Fundamentals of probabilistic methods. Elements of the theory of estimation: confidence intervals, the concepts of relevance and power of the tests. Basics of mathematical modeling of real objects (statics and dynamics of processes). Elements of the verification models. Problems of optimal planning of experiments. Identification of the parameters on the basis of models (size and immeasurable nieobserwowalne). Identification of transmittance of complex systems and multi-dimensional. Identification of state equations. Tuning models. Fuzzy logic and identification of structures.

Course content – laboratory

Identification of dynamic system parameters: classical, weighted and adaptive approaches. The least squares method. Neural network modelling of non-linear dynamic systems. Fuzzy control of non-linear dynamic systems.

Course content – project

Modelling, identification of the structure and parameters of a non-linear dynamic system using grey-box and black-box modelling methods.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Skills mathematical description of physical phenomena and complex technical processes. Knowledge of the subject Mathematics (0411200001, 0411200002), Numerical Methods (0411200009), optimization and decision making (0411200030) and the methods and basis of identification (0411210003)</td></tr>
<tr><td>Assessment methods and criteria</td><td><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>50.0%</td><td>25.0%</td></tr>
<tr><td>Midterm colloquium</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Project</td><td>50.0%</td><td>25.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. Stolc L.: Wstęp do metod optymalizacji i identyfikacji: ćwiczenia i laboratorium, Wyd. PG, Gdańsk 1985.

2. Piegat A.: Modelowanie i sterowanie rozmyte, Exit, Warszawa 1999

3. Gajek L., Kałuszka M.: Wnioskowanie statystyczne, WNT, Warszawa 1994

4. Mańczak K.: Metody identyfikacji wielowymiarowych obiektów sterowania, WNT, Warszawa 1971.</td></tr>
<tr><td>Supplementary literature</td><td>1. Lindgren B.: Elementy teorii decyzji, WNT, Warszawa 1977

2. Volk W.: Statystyka stosowana dla inżynieów, WNT, Warszawa 1973

3. Stoderstrom T., Stoica P.: Identyfikacja systemów, PWN 1997</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>• identification of dynamic object model parameters using the least squares method;
• designing of fuzzy reasoning system for control purposes;
• designing of the neural network model for control purposes on the basis on measured data.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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