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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 2022	Academic year of realisation of subject	2022/2023
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	Department of Control Systems Engineering -> Faculty of Electrical and Control Engineering

Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Grochowski
	Teachers	dr hab. inż. Kazimierz Duzinkiewicz mgr inż. Krzysztof Laddach mgr inż. Mateusz Czyżniewski

Lesson types and methods of instruction	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_U06	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	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
	K7_W01	-Student is able to define an optimization and identification problems; -Student is able to solve optimization and identification problems and verify the correctness of the solution -Student is able to model complex objects and control systems; -Student selects the appropriate method for the identification and validation of complex control plants	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	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. Controls and issues of error correction methods follow-up control. Techniques in cases of stationary and nonstationary processes. LABORATOTY Methodology of experimentation, passive and active. Comparison and application of both techniques. Identification of the characteristics of real objects statyczntch lumped. Identification of object with distributed constants. Identification of complex objects. Identification of structures. Identification of static characteristics of simple technical processes. Identification of the object distributed constant
Prerequisites and co-requisites	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)

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	50.0%	50.0%
Midterm colloquium	50.0%	25.0%
Practical exercise	60.0%	25.0%

Recommended reading

Recommended reading	Basic literature	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. |
| | Supplementary literature | 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 |
| | eResources addresses | Adresy na platformie eNauczanie: |

Example issues/ example questions/ tasks being completed	• 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.
Work placement	Not applicable