GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Numerical Optimization Algorithms, PG_00047436		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
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	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	English
Semester of study	3	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		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Krystyna Rudzińska-Kormańska	
	Teachers	dr inż. Krystyna Rudzińska-Kormańska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	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	2.0	18.0	50

Subject objectives	Practical familiarization with static optimization algorithms and their application in automation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U21] can individually carry out an in-depth analysis of controlling, diagnostics and signal processing problems; and, to an advanced extent, is able to individually design, tune and operate automatic regulation, control and robotics systems; and use computers to control and monitor dynamic systems	Solves numerical methods optimization tasks.	[SU4] Assessment of ability to use methods and tools
[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	Is able to use optimization methods when solving problems in various fields.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n-appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n-application of appropriate methods and toolsn	Can formulate the problem of optimization in mathematical form.	[SU2] Assessment of ability to analyse information
[K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	Uses optimization methods to identify models.	[SU4] Assessment of ability to use methods and tools

Subject contents

1. Introduction to OPTIMUM – specialized software for SO problem solving and SO algorithm properties studying.
2. Introduction to VISUAL - specialized software for graphical representation (2D, 3D) of objective functions, equality and inequality constraints and SO algorithm steps.
3. Comparative study of numerical SO algorithms without constraints – properties and indices:
D) one-dimensional search methods;
E) simple search methods (Rosenbrock, Hook-Jeeves, Nelder-Mead algorithms);
F) methods with directional search (Powell's conjugate directions method);
G) gradient SO methods (steepest descent, conjugate gradient and quasi-Newton methods).
8. Study of properties of numerical SO algorithms with constraints (internal, external and shifted penalty functions).
9. Solving optimal control problems for static physical systems (OPTIMUM software).
10. Solving optimal control problems for dynamical systems (OPTIMUM software).
11. Development of an algorithm for specified problem of continuous optimization. Physical system model.
12. Implementation and testing of the developed algorithm. Presentation of modeled system and optimum solution.
13. Discussion on presented methods and obtained solutions.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory grade	50.0%	100.0%

Recommended reading

Basic literature	1) Computational Optimization Methods Lecture. 2) Laboratory instructions
Supplementary literature	P.E.Gill, W.Murray, M.H.Wright, "Practical Optimization".
eResources addresses	Adresy na platformie eNauczanie:

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