GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Applications of Artificial Intelligence in Optimization, PG_00064022		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
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	exam
Conducting unit	Department of Microelectronic Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Anna Pietrenko-Dąbrowska	
	Teachers	dr hab. inż. Anna Pietrenko-Dąbrowska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	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	Introduction to the application of Artificial Intelligence methods in optimization, with an emphasis on algorithms used for solving design problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, making assessment and critical analysis of the prepared software as well as a synthesis and creative interpretation of information presented with it	The student is capable of applying specific algorithmic approaches to solve design problems, particularly to select, plan, and implement procedures using the discussed optimization algorithms.	[SU1] Assessment of task fulfilment
[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	The student is familiar with artificial intelligence methods used for engineering optimization and is able to select appropriate algorithms for solving real-world design problems.	[SW1] Assessment of factual knowledge
[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	The student is familiar with the concepts of engineering optimization, understands the basic stages of the design process, and recognizes their impact on the final outcome.	[SW1] Assessment of factual knowledge

Subject contents

1. Introduction to Matlab programming
2. Basic concepts used in optimization
3. Introduction to engineering optimization
4. Gradient-based optimization
5. Derivative-free optimization
6. Solving optimization problems in Matlab programming envirinment
7. Stochastic search methods
8. Evolutionary algorithms
9. Multi-objective optimization
10. Surrogate modeling. Design of experiments
11. Data-driven models
12. Physical models. Model validation
13. Surrogate-based engineering optimization
14. Solving real-world optimization problems

Prerequisites and co-requisites

Knowledge of mathematics at the undergraduate level

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Attendance	80.0%	20.0%
Project tasks	50.0%	60.0%
Lecture	50.0%	20.0%

Recommended reading

Basic literature

1. J. Nocedal, S.J. Wright, *Numerical Optimization*, Springer Science, 2006
2. S. S. Rao, *Engineering optimization: Theory and practice*, Wiley, 2019.
3. J. Stadnicki, *Teoria i praktyka rozwiązywania zadań optymalizacji,* PWN, 2017.
4. Matlab documentation

	Supplementary literature	1. Z. Michalewicz, *Genetic algorithms + data structures = evolution programs*, 3rd edn, Springer, New York, 1996. 2. T. Back, D.B. Fogel, and Z. Michalewicz (Editors), *Evolutionary computation 1: basic algorithms and operators*, Taylor & Francis Group, 2000. 3. D.B. Fogel, *Evolutionary computation: toward a new philosophy of machine intelligence*, IEEE Press, 2006. 4. C.A. Coello Coello, G.B. Lamont, and D.A Van Veldhuizen, *Evolutionary algorithms for solving multi-objective problems*, 2nd ed, Springer-Verlag, 2007. 5. K.C. Tan, E.F. Khor, and T.H. Lee, *Multiobjective evolutionary algorithms and applications*, Springer-Verlag, 2005. 6. K. Palmer and K.-L. Tsui, A minimum bias Latin hypercube design, *IIE Transactions*, vol. 33, pp. 793-808, 2001.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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