GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computational Algorithms, PG_00047600		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Optional 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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Automatic Control -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Krzysztof Cisowski	
	Teachers	dr inż. Krzysztof Cisowski	

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	2.0	18.0	50

Subject objectives

Introducing students to basic algorithms of numerical methods and algorithms implementation problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Student describes and knows how to use in practice algorithms of numerical methods for analysis of control systems	[SU4] Assessment of ability to use methods and tools
[K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student describes and knows how to put into practice the basic algorithms for solving systems of linear equations. Student describes and knows how to put into practice the basic algorithms for solving nonlinear equations and systems of nonlinear equations. The student describes and knows how to use in practice the basic methods of interpolation and approximation. The student describes and knows how to use in practice the basic methods of integration, differentiation and solving differential equations	[SW1] Assessment of factual knowledge [SU4] Assessment of ability to use methods and tools

Subject contents	1. Introduction to numerical analysis: errors classification. 2. Root-finding algorithms: bisection method, NewtonRaphson method 3. Root-finding algorithms: secant method, regula falsi method, fixed point iteration. 4. Function interpolation: Lagrange method, Chebyshev method, trigonometric interpolation. 5. Finite differences. Stirling"s interpolation formula, I and II Newton"s interpolation formulas. 6. Function approximation: minimum mean square error (MMSE) approximation for continuous and discrete case. 7. Discretre MMSE approximation based on Gram polynomials and trigonometric polynomials. 8. Approximation using empirical formulas. 9. Direct methods of solving of linear equations systems. Gaussian elimination. 10. Triangular matrix decompositions methods: LU decomposition, QR decomposition. Triangular matrix inversion. 11. Iterative methods of solving of linear equations systems: Jacobi method, Gauss-Seidel method. 12. Methods of solving of nonlinear equations systems: steepest-descent method, Newton-Raphson method. 13. Numerical integration: trapezium rule, Simpson"s rule. 14. Numerical differentiation. Methods of solving of differential equations systems: Euler method, Runge-Kutta method. 15. Discrete Fourier transform (DFT) – fast Fourier transform algorithm (FFT).
Prerequisites and co-requisites	No requirements

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Projects	51.0%	100.0%

Recommended reading	Basic literature	A. Szatkowski, J. Cichosz, Metody numeryczne podstawy teoretyczne, Wydawnictwa Politechniki Gdańskiej, Gdańsk 2002. T. Ratajczak, Metody numeryczne, przykłady i zadania, Wydawnictwa Politechniki Gdańskiej, Gdańsk 2006. Z. Fortuna, J. Wąsowski, B. Macukow, "Metody numeryczne", seria Elektronika, Informatyka, Telekomunikacja, WNT Warszawa 2009. M. Dryja, J. i M. Jankowscy, Przegląd metod i algorytmów numerycznych, WNT, W-wa 1988. R. Chassaing, D. Reay, Digital signal processing and Applications with the C6713 and C6416 DSK, Wiley-Interscience 2008.
	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie: Algorytmy Obliczeniowe 2023/2024 - Moodle ID: 33025 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33025
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	