GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modelling and Simulation Languages , PG_00068336		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
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	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Automatic Control -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Ciołek	
	Teachers	dr inż. Marcin Ciołek	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	0.0	45

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	45	3.0	27.0	75

Subject objectives

New skills of process modelling and simulation using MATLAB language

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_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	Gaining skills of using MATLAB tool	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_U11] can plan and organise individual and team work	Gaining skill of using MATLAB to solve modeling problems	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>Course content – lecture
1. Numerical calculations in floating point arithmetic, standard IEEE. Representation of numbers. Precision. PC machine accuracy. Rounding. Emergencies (NaN, Inf). The loss of accuracy.

2. The "condition number" of a matrix. Accuracy and stability of numerical algorithms. Analysis of errors of the solution of a system of linear equations. Emergencies (NaN, Inf). The loss of accuracy.

3.Representation of the data and addressing in Matlab. Basic elements of data processing in Matlab (sorting, averaging, correlation analysis).

4.Methods for regression and polynomial approximation. Interpolation. Differential Equations and filtration. The Fourier analysis and the Fast Fourier Transform. Multidimensional data structures in Matlab. Emergencies (NaN, Inf). The loss of accuracy.

5. Norms. Dot product. Orthogonality. Projections. Orthogonal transformation. Solving systems of linear equations.

6. Factorization of linear operators. Eigenvalue problem and generalized eigenvalue problem for a linear operator. Decomposition of a linear operator in the singular values.

7. An estimate of the number of linearly independent rows or columns of a full matrix. The Moore-Penrose pseudoinverse. The task of least squares. The sensitivity of the solution of a system of linear equations to errors in the data.

8. Models in state-space linear systems (objects) dynamic invariant with respect to time. Determination of the state space model based on the description of a system of linear ordinary differential equations. Linearization of nonlinear differential equations. Numerical solution of the equation of state.

9. Stiff problems of the dynamic systems. Periodic solution.

10. Modeling objects (processes) of a very large size - methods based on the description in the form of a sparse matrix. Representation of the sparse matrix. Basic arithmetic operations using sparse matrices. Solving systems of linear equations with sparse matrices. Factorization of sparse matrix . Eigenvalue problem of sparse matrix.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></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>The final exam</td><td>50.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. P. Davis: Differential Equations - Modelling with MATLAB, Prentice Hall, 1999.
2. Documentation of MATLABa i SIMULINKa</td></tr>
<tr><td>Supplementary literature</td><td>1. L.F. Shampine, I. Gladwell, S. Thompson: Solving ODEs with MATLAB, Cambridge University Press, 2003.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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