COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical Methods and Simulation [S1AiR1>MNiS]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
practical

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Prerequisites

Knowledge of mathematical description of physical phenomena occurring in automation and robotics systems. Ability to model automation systems and manipulators. Programming using high level C ++, Java, and scripting Python, Matlab etc.

Course objective

Preparing students for using numerical skills in analysis and simulation of systems and processes of analysis in automation and robotics. The course discusses issues related to modeling and description of the phenomenon of growth in automation systems and applications as well as numerical methods of analysis of these systems

Course-related learning outcomes

Knowledge
Modeling methods and description of dynamic systems. Numerical implementation of dynamic models and processes. Numerical solving of equations describing linear and nonlinear systems
Skills
Modeling systems using state equations and simulation of automatics and robotics systems. Assessment of compliance of the numerical results obtained with actual results
Social competences
Understands the need and knows the possibilities of continuous training, raising professional, personal and social competences. Is aware of the need for a professional approach to technical issues and meticulous familiarity with the issues undertaken. He understands the need and the possibility of further transfer of acquired knowledge and skills

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

In the field of laboratory exercises, verification of assumed learning outcomes is carried out by continuous assessment in each class (oral answers, laboratory reports), in addition by assessing acquired knowledge and skills through one or two tests in a semestr.
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Programme content

The lecture program includes the following topics:
Machine representation of numbers and numerical errors, definition and description of dynamic systems, state vector and state space, solving state equations. Methods of analysis of linear systems and processes, numerical solving of systems of linear equations, methods of solving differential equations: Euler, Heun, Taylor series, Runge-Kutta, Runge-Kutty-Fehlberg, methods of analysis of nonlinear systems and processes, numerical solving of systems of nonlinear equations and nonlinear equations differential.
Application and implementation of algorithms for the analysis of linear and non-linear systems and processes in electrical engineering, assessment of convergence of algorithms, stability and proper discretization of the methods used, analysis of the obtained numerical simulation results.
Laboratory exercises are conducted in the form of fifteen 2-hour meetings. Preparation for one meeting is subject to one topic. During classes, students solve received tasks using computers in the indicated virtual environment in the field of material presented in the lectures.
The curriculum includes:
Modeling and numerical implementation of linear and nonlinear static and dynamic systems.
Solving systems of linear and nonlinear equations.
Implementation and analysis of methods for solving Euler, Heun linear differential equations, Taylor series, Runge-Kutta, Runge-Kutty-Fehlberg.
Implementation and analysis of interpolation and extrapolation methods for solving nonlinear differential equations.
Application and implementation of algorithms for system analysis and automatic control processes
Evaluation of convergence of algorithms, stability and proper discretization of the methods used, analysis of the results obtained

Teaching methods

Teaching methods:
1. lecture: multimedia lecture with examples supported by explanations on the board
2. laboratories: numerical implementation and task analysis, discussion

Bibliography

Basic
1. John H. Mathews, Kurtis D. Fink, Numerical Methods using Matlab, Wydawnictwo Prentice Hall 1999r.
2. David Kincaid, Ward Cheney, Analiza numeryczna, Wydawnictwa Naukowo-Techniczne 2006r
Additional
1.Miedzianek M., Stepień S., Numeryczna analiza systemów dynamicznych w środowisku Matlab, PWSZ Leszno, 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	4,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00