Numerical methods - course description

General information

Course name	Numerical methods
Course ID	11.9-WE-AutP-NM-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Automatic Control and Robotics
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2019/2020

Course information

Semester	2
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Andrzej Obuchowicz

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	15	1	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- to familiarize students with the basic numerical methods used in engineering calculations
- forming understanding among students that it is necessary to correctly perform computer calculations that guarantee acceptable errors
- shaping basic skills of a practical application of numerical methods in computer calculations - using the Matlab package

Prerequisites

Mathematical analysis, Linear algebra with analytical geometry

Scope

Computer arithmetic: fixed and the floating-point representation of numbers, calculation errors in the floating-point arithmetic, stability, and correctness of a numerical algorithm, conditioning of a numerical task).

Solving nonlinear equations: bisection method, falsi rule, secant and tangent methods, multiple zeros, systems of nonlinear equations.

Solving problems of linear algebra: exact methods for solving systems of linear equations: Gauss method, pivoting, triangular distribution, Thomas method, Cholesky-Banachiewicz method; iterative methods: Jordan, Gauss-Seidel, determination of determinants and inverse matrix, spectral problem.

Interpolation: definition and classification of methods, polynomial interpolation: Lagrange interpolation formula, Newton interpolation formula; trigonometric interpolation, interpolation with spline functions, cubic spline.

Approximation: discrete and continuous mean square approximation, triangular families of orthogonal polynomials in approximation.

Quadratures: a complex pattern of rectangles and triangles, Newton-Cotes quadrature, Gaussian quadrature, numerical integration of integrals with improper boundaries, and with singular points inside the integration interval, integration of multidimensional functions.

Ordinary differential equations: Euler method, Rung-Kutta methods. Introduction to boundary problem methods and partial differential equations.

Matlab engineering calculations environment.

Teaching methods

Lecture: traditional lecture

Laboratory: lab exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Students are aware of the fact that every computer calculation is accompanied by errors, understands their nature and knows how to avoid them		• test	• Lecture
Students can independently, based on literature, solve a simple problem calculation		• test, lab exercise reports	• Laboratory

Outcome description	Outcome symbols	Methods of verification	The class form
Students are able to use his general engineering and mathematical knowledge in carrying out calculations and estimating the correctness of their result		• test, lab exercise reports	• Laboratory
Students can work individually and in a team		• current control in class	• Laboratory
Students know the basic numerical methods used in solving tasks computational, commonly used in engineering calculations.		• test	• Lecture
Students are able to apply numerical methods in practical computer calculations using the Matlab environment		• test, lab exercise reports	• Laboratory

Assignment conditions

Wykład - warunkiem zaliczenia jest uzyskanie pozytywnej oceny z kolokwium zaliczeniowego w formie pisemnej

Laboratorium - warunkiem zaliczenia jest uzyskanie pozytywnych ocen ze wszystkich ćwiczeń laboratoryjnych, przewidzianych do realizacji w ramach programu laboratorium

Składowe oceny końcowej = wykład: 50% + laboratorium: 50%

Recommended reading

1. Stachurski M.: Metody numeryczne w programie Matlab, Mikom, Warszawa, 2003.
2. Zalewski A., Cegieła R.: MATLAB: obliczenia numeryczne i ich zastosowania, Poznań, 2002.
3. Fortuna Z., Macukow B., Wąsowski J.: Metody numeryczne, WNT, Warszawa, 1995

Further reading

1. Wanat K.: Algorytmy numeryczne, Helion, Gliwice, 1994
2. Bjorck A., Dahlquist G.: Metody numeryczne, PWN, Warszawa, 198

Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 29-04-2020 09:21)