

Numerical methods in engineering - opis przedmiotu

Informacje ogólne	
Nazwa przedmiotu	Numerical methods in engineering
Kod przedmiotu	11.9-WE-ELEKTD-NumMethinTechn-Er
Wydział	Wydział Informatyki, Elektrotechniki i Automatyki
Kierunek	Elektrotechnika
Profil	ogólnoakademicki
Rodzaj studiów	Program Erasmus drugiego stopnia
Semestr rozpoczęcia	semestr zimowy 2022/2023

Informacje o przedmiocie	
Semestr	1
Liczba punktów ECTS do zdobycia	3
Typ przedmiotu	obowiązkowy
Język nauczania	angielski
Sylabus opracował	- prof. dr hab. Roman Gielerak - prof. dr hab. inż. Igor Korotyeyev

Formy zajęć					
Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Wykład	15	1	-	-	Egzamin
Laboratorium	15	1	-	-	Zaliczenie na ocenę

Cel przedmiotu

- to introduce to the basics of the very nature of floating-point arithmetic and threats resulting from its use
- to familiarize students with the basic numerical algorithms used in modeling and engineering calculations performed with the use of computer techniques
- to introduce basic numerical algorithms for solving typical computational tasks emerging in the process of modeling technical systems and processes encountered in the analytical work of an engineer with specialties related to electrical engineering

Wymagania wstępne

Mathematical analysis, Selected issues of circuit theory I, Numerical method

Zakres tematyczny

Mathematical foundations: standards and assumptions of variable-point arithmetic with finite precision. Basic definitions and types of errors. Numerical tasks and their numerical conditioning, numerical stability, ways of avoiding errors

Basic issues of linear algebra: matrix calculus, systems of linear equations and numerical algorithms for solving them: Gaussian elimination algorithm and the problem of optimal element selection. Iterative methods: Gauss-Seidel algorithm and Jacobi algorithm. Fixed point methods. Applications for numerical calculations on matrices. Fixed point methods: solving equations and systems of nonlinear equations using Newton's algorithm.

Interpolation techniques and their applications: polynomial interpolations, van der Monde linear systems and their numerical instability, Lagrange and Newton methods, the method of splines, in particular the technique of cubic splines. Applications of interpolation techniques to numerical integration :Newton-Cotte series . Gaussian quadratures.

Approximation techniques: minimal sum of squares error polynomial approximations, numerical instabilities in the tasks of discrete approximation, orthogonal polynomials and their applications. Approximation with trigonometric polynomials, Fourier series and their applications. Min-max error minimization error problems.

Initial and boundary problems for ordinary differential equations. Mathematical introduction and review of applications of ordinary equations in electrical engineering. Numerical algorithms for initial problems: Euler's algorithm, Runge-Kuty algorithms. Numerical algorithms for boundary problems.

Metody kształcenia

Lecture, laboratory exercises

Efekty uczenia się i metody weryfikacji osiągnięcia efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
Is aware of fact, that with every computer calculations are connected with errors, understand there nature and know methods to their avoiding		obserwacja i ocena aktywności na zajęciach	Wykład
Know basic numerical methods applied for solving computational problems which are used overall in engineering computations		kolokwium	Wykład

Opis efektu	Symbol	efektów	Metody weryfikacji	Forma zajęć
Can work individually and collectively			• obserwacja i ocena aktywności na zajęciach	• Laboratorium
Can use Matlab in computer performed computations			• obserwacje i ocena umiejętności praktycznych studenta	• Laboratorium
Can use his general engineering and mathematical knowledge in the process of computations			• sprawdzian	• Laboratorium

Warunki zaliczenia

Lecture –the necessary passing condition is to obtain a positive grade from final exam.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Calculation of the final grade: lecture 50% + laboratory 50%

Literatura podstawowa

1. Lloyd N. Trefethen and David Bau, III: Numerical Linear Algebra, SIAM, 1997
2. H.M. Antia: Numerical Methods for Scientists and Engineers, Birkhauser, 2000
3. Richard L. Burden, J. Douglas Faires, Numerical analysis, Brooks /Cole Publishing Company, ITP An International Thomson Publishing Company, sixth edition, 1997
4. Kendall Atkinson, Elementary numerical anlysis, John Wiley & Sons, Inc., second edition, 1993.
5. Abhishek K Gupta, Numerical Methods using MATLAB, Springer, 2014.
6. C. Woodford, C. Phillips, Numerical Methods with Worked Examples: Matlab Edition, Springer, 2012.

Literatura uzupełniająca

1. S.R. Otto, J.P. Denier, An Introduction to Programming and Numerical Methods in MATLAB, Springer, 2005.

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Uwagi

Zmodyfikowane przez dr hab. inż. Krzysztof Sozański, prof. UZ (ostatnia modyfikacja: 21-04-2022 23:08)

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