Tárgytematika / Course Description
Numerical Analysis

GKNM_MSTA003

Tárgyfelelős neve / Teacher's name: dr. Gáspár Csaba Ferenc
Félév / Semester: 2025/26/1
Beszámolási forma / Assesment: Vizsga
Tárgy heti óraszáma / Teaching hours(week): 2/2/0
Tárgy féléves óraszáma / Teaching hours(sem.): 0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

The aim of the course is to provide an introduction to the tools of the classical and modern numerical analysis. The students can implement a part of the investigated methods in MATLAB language.

TANTÁRGY TARTALMA / DESCRIPTION

Week 1: Vector norms (Euclidean, sum, maximum norm). Matrix norms induced by vector norms.

Week 2: Banach's fixed point theorem and its applications.

Week 3: Direct methods for linear systems of equations. The Gaussian elimination and its variants.

Week 4: Gaussian elimination for regular and singular matrices. Inversion of matrices.

Week 5: Iterative methods for linear systems of equations. Fixed point iteration, Ricardson's iteration, the optimal choice of the iteration parameter. The Jacobi and Seidel iterations.

Week 6: Iterative methods for linear systems of equations. Variational methods, the (conjugate) gradient method. The method of least squares.

Week 7: Approximation of the extremal eigenvalues. The power iteration and the inverse iteration.

Week 8: Univariate interpolation problems. Lagrange, Hermite, and cubic spline interpolation.

Week 9: Multivariate interpolation. Shepard's method and the Method of Radial Basis Functions.

Week 10: Nonlinear equations. Fixed point iteration. Newton's method and its variants.

Week 11: Numerical solution of ordinary differential equations. Euler's method and its improvements.

Week 12: Partial differential equations. Initial and boundary conditions.

Week 13: Numerical solution of partial differential equations by finite difference schemes.

Week 14: The principles of the finite element method.

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

Two mid-term exams are necessary during the semester.

The exam is divided into two parts: written and oral examination. Only students who have reached 51% in the written part can take the oral exam.

The marking criteria: the written part is worth a total of 40 marks and the oral part is worth a total of 20 marks. 21 marks are required for a sufficient grade. The evaluation process uses a 5-point grading scale. The final grade is determined in the following way:

0 - 20 insufficient (1),

21 - 30 sufficient (2),

31 – 40 satisfactory (3),

41 – 50 good (4),

51 - 60 excellent (5).

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Jaan Kiusalaas: Numerical Methods in Engineering with Python. Cambridge University Press, The Edinburgh Building, Cambridge, UK

www.cambridge.org/9780521852876

http://index-of.es/Python/Numerical.Methods.in.Engineering.with.Python.Jaan.Kiusalaas.2005.pdf

AJÁNLOTT IRODALOM / RECOMMENDED MATERIAL