Tárgytematika / Course Description

Numerical Analysis

GKNM_MSTA003

Tárgyfelelős neve / Teacher's name: dr. Gáspár Csaba

Félév / Semester: 2017/18/1

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 this subject is to give an introduction to the modern computational methods. The theoretical background is the concept of vector spaces, normed spaces and the usual analytical tools such as elementary analysis (including differential and integral calculus) and linear algebra. Various computational methods are introduced and analysed concerning linear and nonlinear equations, interpolation problems as well as simple ordinary and partial differential equations.

TANTÁRGY TARTALMA / DESCRIPTION

Week 1: Vector and matrix norms. Eucliedean, sum and maximum norm. Matrix norms induced by vector norms.
Week 2: Banach's fixed point theorem for univariate and multivariate functions. Applications.
Week 3: Direct solution of linear system of equations. The Gaussian elimination and its variants. Partial and full pivoting.
Week 4: Direct solution of linear system of equations. The case of regular and singular matrices. Inverting matrices by Gaussian elimination.
Week 5: Iterative solution of linear system of equations. Fixed point iteration. Iteration with optimal parameter. The Jacobi and Seidel iteration.
Week 6: Iterative solution of linear system of equations. Variational methods. The gradient and the conjugate gradient method. The method of least squares.
Week 7: Approximate calculation of extremal eigenvalues. The power method and the inverse iteration.
Week 8: Univariate interpolation. The classical Lagrange and Hermite interpolation. The cubic spline interpolation.
Week 9: Scattered data interpolation. Shepard's method and the method of radial basis functions.
Week 10: Numerical solution techniques of nonlinear equations. The fixed point theorem. Newton's method and its variants.
Week 11: Numerical solution of ordinary differential equations, Euler's method and its improvements.
Week 12: Numerical solution of partial differential equations. Partial differential equations, initial and boundary conditions.
Week 13: Numerical solution of partial differential equations. Discretisation by finite differences.
Week 14: Numerical solution of partial differential equations. An introduction to the finite element method.

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL