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# Elements of numerical analysis

## Finalità

OBJECTIVES: introduction to the basic methods and algorithms of Numerical Analysis

## Programma

### Error analysis

Conditioning of a problem and stability of an algorithm. Errors in computations. Rounding errors and floating-point arithmetic.

### Polynomial interpolation

Lagrange form of the interpolating polynomial. Divided differences and the Newton form of the interpolating polynomial. Interpolation Polynomials and Remainder Terms for Equidistant Nodes. Stability of the interpolating polynomial. Divergence of sequences of interpolation polynomials. Hermite interpolation. Linear spline interpolation. Convergence.

### Numerical integration

Interpolatory numerical integration. Newton-Cotes formulas. Errors of quadrature formulas. Automatic integration.

### Numerical linear algebra

Condition number. Triangular system solution. Gaussian elimination. Pivoting and scaling. Direct factorization methods. LU-decomposition. Determinant and invers of a square matrix. Tridiagonal matrices.

### Numerical solution of nonlinear equations

Conditioning of a nonlinear equation. Bisection method. Newton's method. Convergence of Newton's method. Rate of convergence. Stop tests. Roots of algebraic polynomials. Newton-Horner method.

### Introduction to MATLAB

Matlab as computational environment. Array and matrices. Files, functions and data structures. Matlab as programming language. Diagrams. Graphics. Matlab functions for the solution of some Numerical Analysis problems. Matlab as a tool to implement and analyse numerical algorithms.

## Modalità d'esame

Written exam

## Testi consigliati

G. Naldi, L. Pareschi, G. Russo, Introduzione al Calcolo Scientifico. Metodi e applicazioni con Matlab, Mc Graw-Hill, 2001

V. Comincioli, Analisi Numerica, Mc Graw-Hill, 1995

A. Quarteroni, R. Sacco, F. Saleri, Matematica Numerica, Springer

J. Stoer, Introduzione all'analisi numerica, Vol. I, Zanichelli, 1974

W. J. Palm, MATLAB 6 per l'ingegneria e le scienze. McGraw-Hill, 2001