Math 150 : Introduction to Numerical Analysis

California State University, Sacramento · Department of Mathematics & Statistics

Finite differences and applications, interpolations, inverse interpolations; numerical differentiation and integration; inverses of matrices; numerical methods of solution of linear equations; algebraicand transcendental equations; numerical methods of solving ordinary and partial differential equations. Some computer programming is desirable.

Catalog Description

Numerical solutions of algebraic and transcendental equations; interpolation, inverse interpolation, finite differences, cubic splines, and applications; numerical differentiation and integration; direct and iterative numerical solutions of linear systems; discrete and continuous least squares approximation. **Graded**: Graded Student. **Units**: 3.0.

Prerequisites

Math 31. It is strongly encouraged that students have some experience with computer programming.

Text

(Required) Numerical Analysis 2/e, by Timothy Sauer

Text

(Recommended) An Introduction to MATLAB and Mathcad, by Troy Siemers

Course Outline

I. Introduction

- A. What is Numerical Analysis?
- B. Some definitions
- C. Mathematical background

II. The Solution of Nonlinear Equations in One Variable

- A. Bisection method
- B. Fixed-point iteration
- C. The Newton-Raphson method
- D. The secant method

III. Systems of Linear Equations

- A. Gaussian elimination
- B. *LU*-factorization
- C. Gauss-Seidel iteration

IV. Interpolation

   A. The Lagrange form of the interpolating polynomial
   B. Newton's forward-difference formula
   C. Chebyshev polynomials

V. Numerical Differentiation & Integration

   A. Numerical Differentiation
   B. Newton-Cotes Formulas
      1. The trapezoidal rule
      2. Simpson's rule
   C. Romberg integration
   D. Gaussian quadrature

VI. Differential Equations

   A. Euler's method
   B. Taylor series method
   C. Runge-Kutta methods