數值分析

Numerical Analysis

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Course Description

- Prerequisites
  - Introduction to computer (計算機概論)
- Objective
  - This course teaches the fundamentals of programming language (MATLAB) and numerical methods
- Textbook and References
  - Numerical Methods: An Introduction with Applications Using MATLAB, A. Gilat and V. Subramaniam, John Wiley, 2nd edition, 2011
  - Lecture Notes from the Instructor https://e3.nycu.edu.tw/

Course outline (1)

- Introduction
  - Introduction to programming language
- Solving nonlinear equations
  - Background, estimation of errors in numerical solutions, bisection method, Newton's method, secant method, fixed-point iteration method, system of nonlinear equations
- Solving a system of linear equations
  - Background, Gauss elimination method, LU decomposition method, iterative method, eigenvalues and eigenvectors
- Curve fitting and interpolation
  - Curve fitting with linear/nonlinear equations, curve fitting with quadratic and higher-order polynomials, Interpolation

Course outline (2)

- Numerical Differentiation
  - Finite difference approximation, finite difference formulas using Taylor series expansion, differentiation formulas using Lagrange polynomials
- Numerical integration
  - Rectangle and midpoint methods, trapezoidal method, Simpson's method, Gauss quadrature, evaluation of multiple integrals
- Solving ordinary differential equations
  - initial value problems, boundary value problems

Grading Policy

- Homework (20%)
  - Attendance and in-class assignment **every week**
  - Take home assignment

- Midterm Exam (40%) Final Exam (40%)

  (1) Problems to be solved by hand

  (2) Problems to be programmed in MATLAB