AMSC 460 Computational Methods

Spring 2011

Course Description:

Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of nonlinear equations, systems of linear equations, and initial value problems for ordinary differential equations. Emphasis on the methods and their computational properties rather on their analytic aspects.

Prerequisite/Corequisite and Credits:

- MATH 240 and 241, CMSC 105 or CMSC 106 or CMSC 114 or ENEE 114.
- Homework assignment will include exercises using MATLAB;
  Familiarity with and accessibility to MATLAB are expected.

Textbook:

- Required: *Introduction to Scientific Computing (2nd Edition)* by C.F. van Loan [ISBN 0139491570]
- Suggested: *Numerical Computing with Matlab* by Cleve B. Moler [online text available]

MATLAB Resources:

- Access to MATLAB: Individual students are responsible for gaining the access to MATLAB
  - Using the univeristy computes that already have MATLAB
  - Student Edition of MATLAB available from UMD OIT
- Users guides
  - Tutorial at University of Maryland.
  - Introduction at University of Maryland.
  - Many other resources are available online.
- Demo codes
  - Basic plotting [Feb 15]

Instructor: Kayo Ide

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  at AOSC: CSS 3403

Grader: Adrienne Norwood

- Email: anorwood at math.umd.edu [contact by email for appointment]

Schedule:

Weekly

9:30am-10:45am	TuTh	[CSIC 2118] Class
2:00pm- 3:00pm	Tu	[CSS 3403] Office hour
3:00pm- 4:00pm	W	[CSIC 4127] Office hour

Exams

Around March 31	Th	Mid Term[to be announced]
May 13, 8:00am-10:00am	F	Final

Outline of the Course:

Topics to be Covered

- Introduction, Computer Arithmetic, and Errors
  - Course Overview
  - Floating Point Representation
  - Approximation and Error Analysis
- Interpolation and Approximation of Functions
  - Polynomical Interpolation
  - Piecewise Polynomial Interpolation
  - Spline Interpolation
- Integration
  - Simple Rules
  - Adaptive Rules
- Matrix Computation
- Solution of Linear Equations
  - Gaussian Elimination
  - Pivoting and Conditioning
  - Sparse Systems
  - Least Squares
- Solution of Nonlinear Equations and Optimization
  - Rootfinding and Minimization of Scalar Functions
  - Minimization of Multivariate Functions
- Solution of Ordinary Differential Equations
  - One- and Multi-step Methods
  - Stiff Systems

Grading & Policy:

- Grades will be based on: homework (5+) 40%; mid-term 25%; final 35%.
- Students are responsible for checking the UMD Honor code (http://www.shc.umd.edu/code.html)
- Homework
  - No late homework will be accepted without prior arrangement.
  - Use of external references should be cited.
  - Students may study together and discuss problems and methods of solution with each other to improve understanding in a general way.
  - Clear similarities between your work and others will result in a grade reduction for all parties.
  - Flagrant violations will be referred to appropriate university authorities.

Homework Sets:

- Homework 1 [Problem Set]

Lecture Notes:

- Background & Motivation (Part of Lecture 1)

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