Introduction to Numerical Methods
CS412, Spring 2006

Instructor

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Course Homepage

http://www.cs.wisc.edu/~cs412-1

Textbook

Applied Numerical Methods with MATLAB for Engineers and Scientists
Author: Steven C. Chapra
Publisher: McGraw Hill

Prerequisites

Math 222 and either CS 240 or Math 234, and CS 302, or equivalent, and knowledge of matrix algebra.

Catalog description

This course is an introduction to algorithms used by engineers and scientists to find solutions (interpolation points and function coefficients) to continuous problems. Some of the problems we will focus on include non-linear equations, polynomial interpolation, numerical differentiation and integration, solution of linear systems, least-squares methods, and numerical solution of ordinary differential equations.

Informal description

This course assumes that you know how to program a computer in a high-level language (HLL) such as C++ or Java. While we will be using MATLAB, you will be given pseudocode in a high-level language. This course will give you an understanding of how continuous problems can be approximated within a given error. You will learn about the types of errors and level of accuracy that each algorithm generates. This will give you insight into selecting the appropriate algorithms for your computational demands.

MATLAB

We will be using MATLAB, a Linear Algebra-based interactive language. No prior knowledge on MATLAB is required or assumed. The text, class sessions and help feature will give you all needed knowledge about MATLAB.

Computer Access

We will be using the CS department's UNIX machines. If you are new to the CS department, you can access your account by following the 'new user' procedure posted in posted in each CS lab. The CSL also provides UNIX orientation sessions for new users on January 18, 19, and 23 at 4pm in cs1325.

Grading Policy

Your grades consist of a midterm (25%), final (35%), and six Homework assignments (5% each). There are <u>no make-ups</u> on exams. All homeworks will be turned in as PDFs and .m files via your handin directories by the time specified on the homework. Assignments may be turned in late, but they will incur a significant penalty. One day late is defined as a 24-hour period following the scheduled due date (weekday or weekend). The following penalties will apply:

- 1 day late: 25% deduction, up to 24 hours late
- 2 days late: 50% deduction, from 24 to 48 hours late
- more than 2 days late: no work will be accepted after 48 hours late.

For example, if an assignment is due at 8:30am on a Wednesday and it is handed in after 8:30am on Wednesday, but before 8:30am on Thursday, a 25% penalty will be deducted.

In this course:

- All assignments are to be done individually.
- You may discuss topics and concepts with others, but not individual solutions to homework questions or programs.
- You may not share program code.
- If you have any doubts about collaboration, please ask your instructor for clarification.

Week	Dates	Topics (Chapters)
1	Jan 17-20	Introduction- Overview, Motivation (Ch 1), MATLAB (Ch 2)
2	Jan 23-27	MATLAB programming (Ch 3), Errors (Ch 4)
3	Jan 30-Feb 3	Bracketing Methods (Ch 5)
4	Feb 6-10	Open methods (Ch 6)
5	Feb 13-17	Matrix review (Ch 7), Naive Gauss Elimination (Ch 8)
6	Feb 20-24	LU Decomposition (Ch 9), Gauss Elimination, Cholesky Decomposition
7	Feb 27-Mar 3	Inverses (Ch 10)
8	Mar 6-10	Iterative methods (Ch 11)
9	Mar 13-17	No class- Spring Break
10	Mar 20-24	Curve Fitting: (Ch 12), Linear Least-Squares
11	Mar 27-31	General Linear Least-Squares (Ch 13), Nonlinear Regression
12	Apr 3-7	Polynomial Interpolation: (Ch 14), Newton, Lagrange, Inverse
13	Apr 10-14	Splines: (Ch 15), Linear, Quadratic, Cubic
14	Apr 17-21	Numerical integration: (Ch 16), Trapezoidal Rule, Simpson's Rule, Open methods, Gauss (Ch 17)
15	Apr 24-28	ODE: (Ch 17), Euler, Runge-Kutta, Multistep (Ch 18)
16	May 1-5	Eigenvalues (Ch 20), Polynomial, Power

Exam Dates

Midterm: Thursday, March 9th from 5:30-7pm (Location: tba)
Final: Friday, May 12th from 7:45-9:45am (Location: tba)

Note: I reserve the right to modify any item as needed to match the class's progress.