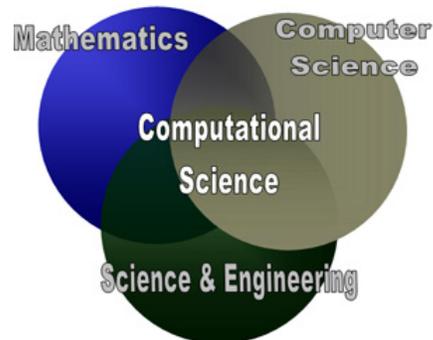
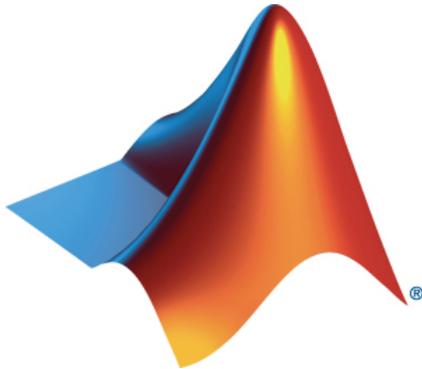


CME 292: Advanced MATLAB for Scientific Computing

Schedule: Spring 2014, TuTh 2:15p - 3:30p, Thorton210

Units: 1



Course Description

The goal of this 8-lecture course is to teach advanced MATLAB features, syntaxes, and toolboxes not traditionally found in an introductory course; applications will be drawn from various topics from scientific computing. Lectures will be interactive with breaks for students to write code and experiment with various MATLAB features. Applications will be drawn from numerical linear algebra, optimization, and numerical solutions to Ordinary and Partial Differential Equations.

Students will have the opportunity to design an optional 9th lecture on MATLAB-related topics that were not covered in the first 8 lectures. Students should expect to gain: ♦ exposure to the tools available in the MATLAB software ♦ knowledge of and experience with advanced MATLAB features ♦ independence as a MATLAB user. Successful completion of the course requires satisfactory submission of four homework assignments.

Course Outline

- Lecture 1
 - Fundamental MATLAB features, syntaxes, concepts [1]
 - * Data types
 - * Functions/scripts, publishing
 - * Debugger, profiler
 - * Memory management
 - * Numeric arrays
- Lecture 2
 - Graphics
 - * Advanced Plotting Functions
 - Vector fields
 - Contour plots, surfaces, volumes, polygons
 - * Graphics handles and objects
 - * Publication-quality graphics
 - * Animation

- Lecture 3
 - Numerical linear algebra [2, 3]
 - * Dense vs. sparse matrices
 - * Direct vs. iterative linear system solvers
 - * Matrix decompositions
 - LU, Cholesky, QR factorizations
 - Eigenvalue decomposition (EVD)
 - Singular value decomposition (SVD)
- Lecture 4
 - Numerical optimization [4, 5, 6]
 - * Optimization toolbox [6]
 - Solution of nonlinear systems of equations
- Lecture 5
 - Object-oriented programming
 - * User-defined classes
- Lecture 6
 - File manipulation and system interaction
 - * Text/binary file manipulation
 - * System calls
 - * Interfacing to spreadsheet (Excel)
- Lecture 7
 - MEX interface to low-level coding languages (C/C++/Fortran)
 - Generating standalone C/C++ code from MATLAB code
 - * MATLAB Coder
- Lecture 8
 - Symbolic Math Toolbox
 - Parallel Computing Toolbox
 - ODEs/PDEs [7, 8]
 - * PDE Toolbox

Prerequisites

- (required) Basic programming skills in MATLAB (CME 192 or equivalent)
- (recommended) Basic knowledge of numerical analysis and numerical linear algebra

Instructor

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References

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