Computational Science:
Computational Methods in Engineering

Course Introduction

Outline

• What are computational methods?
• Rules and procedures for the course
• Your computer codes
What are Computational Methods?

Electromagnetic Simulations
2D Fast Fourier Transform

Dart Throwing Analysis
Analysis of Microwave Transmission Lines

Problem definition:

Problem results:

$L = 554 \text{ mm}, C = 121 \text{ mm}, \varepsilon_{\text{eff}} = 6.0, Z_c = 67.78 \Omega$

Spatially Variant Lattices (1 of 3)
Spatially Variant Lattices (1 of 3)
Needed for This Course

1. A scientific calculator
2. Access to a computer with MATLAB installed.
3. Internet access
4. Text Book

Course Outline

- Review of MATLAB
- Numerical error
- Review of linear algebra
- Finding roots of equations
- Fitting curves to data
- Numerical differentiation and integration
- Finite-difference method for solving ODEs.
- Optimization

Awesome Graphics
Homework Rules/Format

• Do your own work. Do not copy from other students.
• Due by 11:59pm on due date. No late homework accepted.
• Submit homework as a single PDF document by uploading to Blackboard.
• Must have a cover sheet.
• Provide all answers and in the order the questions were asked.
• Final answers clearly marked with a box.
• All computer codes placed at end of assignment in an Appendix.
• High level of professionalism – exceed that of the solutions.
• Must include a *signed* graphics checklist at the end of each assignment that includes graphics.
• Extremely good graphics – See checklists

Typical Outline of Homework

• Cover sheet
  • Name + 800#
  • Course information + Date
  • Homework #
• Answers and work to problems (no codes)
• Appendix
  • All computer codes go here
• Graphics checklist if homework contains graphics
Grading

Homework is critical in this course! 
Note it is worth 40% of your grade! 
No late homework accepted! 
Due data/time enforced by Blackboard!

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<tr>
<td>Homework</td>
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<td>Midterm Exams</td>
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90% – 100% → A  
80% – 89% → B  
70% – 79% → C  
60% – 69% → D  
0% – 59% → F

Participation ➔ Discussion Boards

• At least two posts to discussion boards per week.
• Ask questions or respond to others’ questions
• Post help (not answers) or suggestions.
• Provide feedback or suggestions to improve the course.
• Do not post codes that are part of solutions to homework or exams
• Do not give any answers to homework or exams
• Keep it professional and polite.
• Post only topics related to the course
• Anonymous posting enabled
Unique Things About Rumpf

• Classes start and end exactly on time. Show up several minutes early to be ready.
• Crazy about proper formatting and high-quality graphics
• Want to encourage questions and interactions
  • Grades are never lowered from your given grade, even if a blatant grading error was made.
• Expects code that:
  • Is clean, well-organized, and well-commented.
  • Follows block diagrams exactly

Your Computer Codes
Structure of the Ideal Code

Initialize MATLAB
- close all unnecessary windows
- clear memory
- open a figure window
- define units and constants

Dashboard
- Define all numbers.
- Do not implement any part of your algorithm.

Rest of Code
Only numbers. No calculations!

Save/Show Results
Only calculations. No numbers!

Rules For Your MATLAB Codes

• You must use MATLAB for all homework and exams.
• Programs must follow the block diagrams in the class exactly.
• Codes must be neat, well organized, and well commented.
• Unless otherwise instructed, code must be a single program and NOT broken into separate functions.
• Try to use the same variable names as the notes and in the codes written by the instructor.
• No vestigial code (i.e. code that has no purpose or effect).
• Need help? If you are stuck: (1) be sure to follow ALL of the above rules, (2) e-mail me your MATLAB code.
  • rcrumpf@utep.edu
  • Cannot provide help on exams.
Advice for Computation

• Write clean code that is well organized and well commented.
• Follow block diagrams in the notes exactly.
• Do not make artificial corrections. For example, do not change an equation in the notes in order to get your code working. There must be another problem. Find the problem.

Course Website
CMEE Website(s)

https://blackboardlearn.utep.edu/ultra/courses/_115932_1/cl/outline

https://empossible.net/academics/emp4301_5301/