

Math 574 – The Finite Element Method
Spring 2006 - TR 9:40-10:55 - Ayres 316

Course Information:

This course is an introduction to the Finite Element Method (FEM) for solving partial differential equations. The main focus of the course will be the mathematical theory for FEM, however, a significant portion of the course will cover computer implementation of the method.

The ideal background for a student wanting to get the most out of this course would include an understanding of numerical analysis (e.g. Math 471) and numerical linear algebra (e.g. Math 472 or 571), a knowledge of partial differential equations (e.g. Math 453, 512 or 535-6), some mathematical maturity (e.g. a course in analysis), and programming experience. The minimum requirements would be some knowledge of PDEs and numerical methods, a good background in calculus and some programming experience.

Resources:

- ◇ Text: *Finite Elements*, by Dietrich Braess, Cambridge, 2001.
- ◇ Webpage: <http://www.math.utk.edu/~ccollins/M574>: Source of other resources, class information, handouts, homework, etc.

Course Outline: (day-to-day will be kept on webpage)

1. PDEs: Classification and standard problems and properties (Chapter I§1-2)
2. Finite Difference Method (Chapter I§3-4)
3. Background for FEM (Chapter II§1-3)
4. FEM Basics (Chapter II§4-6)
5. Errors in FEM (Chapter II§6-7)
6. Solution Methods: CG and Multigrid (Chapter IV & Chapter V)
7. Variations on FEM (Chapter II)

Assignments: The FEM breaks the solution process into several manageable pieces and so to learn the FEM you'll need to have a chance to practice working with those pieces. This will be done in the homework. You also need practice putting all the pieces together and actually seeing how the method works. This will be done in the projects.

- ◇ Homework: 10 points per problem, assigned irregularly from the book and other sources
- ◇ Projects: 100 points each, 2 or 3 assigned during the semester, include some programming
- ◇ Final Project: 200 points, due at the end of the course

Your final grade will be determined by what percentage of the total available points you earn.

Instructor:

Charles Collins - 312B Ayres Hall - 974-4269 or 974-2461 - ccollins@math.utk.edu
Office Hours: M 3-4, TR 11-12

Late-Work Policy:

All work is to be turned in by the end of class on the day that it is due. Late work will be penalized 20% per day (off of base value), unless there is a previous arrangement or proof of emergency. Each student gets **one** free late-turn-in for homework, where they can turn in the assignment at the beginning of the next class period with no penalty.