CIVE 565: FINITE ELEMENT METHOD
SPRING 2018

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Prerequisites: M 340 and the motivation to learn.

Course philosophy: Without question, the finite element method is the most important and widely used technique to solve a wide array of problems in all branches of engineering. In this class, we do not focus on a single branch but bring in example differential equations from physics, heat transfer, fluids, solids, and structures. We write, as a class, our own two-dimensional finite element code to solve the two-dimensional Poisson equation so that you have an understanding of what is contained within commercial finite element programs. You will leave the class with that understanding and the knowledge required to create more complex finite element models in your future.

No textbook - they are extremely expensive. If you can find one used, I suggest: An Introduction to the Finite Element Method, by J. N. Reddy, McGraw-Hill, 3rd edition. Our class notes will be the primary resource/exam material used in the class.

Objectives: To understand the mathematical foundations and implement numerical solution techniques for the finite element method for static and dynamic problems in engineering.

I assign grades based on the plus/minus system, with the usual averages being used in the 90-100 percent (A/A-) range, 80-89 percent (B+/B/B-) range, and so on. I always try to let you know where you stand after each exam.
Grading will be based on the following algorithm:

1. Homework: 20 % You can work together and consult me or classmates regarding the problems, but everything you turn in must be your own work. Any plots, results, numbers, and so on must clearly be your own work, and when we have computational problems your computer code must be significantly different from your classmates and clearly the result of your own effort.

2. Two Exams: 45 % We will hold these at roughly 1/3 and 2/3 of the way through the course, and I will give you at least one week notice. They are closed book and notes, but you can use a calculator.

3. Final exam (comprehensive): 35 % Closed book but you can use one sheet of 8.5 x 11 inch paper with writing on both sides to help you.

TOPICS

1. Weighted Residuals, Variational Formulations and Weak Forms

2. Finite Element Approximations

3. One-Dimensional Problems:

   - Second-order equations
   - Fourth-order equations
   - Isoparametric elements and numerical integration
   - Computational strategies

4. Two-Dimensional Problems:

   - Second-order single variable equations
   - Isoparametric elements and numerical integration
   - Second-order multivariable equations
   - Computational strategies

5. Time Dependent Problems

6. Eigenvalue Problems

COMMENTS

1. Do not get behind in study of the notes and the references. I strongly suggest you copy your notes after each class, making sure you understand each step.

2. Completion of the homework is a critical part of this class. Use any resource available to you but make sure the work you turn in is understood and is yours.

3. We will likely be programming in MATLAB. From past experience, this can be a steep learning curve for some students who have either never used it or have not used it for some time. I will try to help with this, up to almost writing our code in class. But you might want to at least introduce yourself to MATLAB if you have not yet used it.