CEE254: Introduction to the Finite Element Method
Class: TuThu 8:30–9:45am, Hudson 212

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Office hours	Thursday 3-4 or by appointment

Textbook: T.J.R Hughes, The Finite Element Method (Prentice Hall, 1987)

Grading Scheme:

Homework:	20%	Exams (2 midterms):	50%
Class participation:	5%	Final Exam:	25%

Exams: Two take-home midterm exams and a final will be assigned in this course approximately two weeks before their due dates (to be announced). Independent work on these is mandatory. These exams are considered to be an integral part of the class and will typically take a significant amount of work/thinking on your part. Do not start them a day before the due date.

Homework: Homework will be assigned approximately every other week during the semester and will be graded (all or only selected problems). Diligence in completing these assignments is essential for understanding the material. I do not discourage working together on homework; however, plagiarism will not be tolerated.

Programs: You will be assigned a number of programming assignments during the course of the semester. These will be relatively short assignments and due approximately one week after they are assigned. I may ask you to write these assignments up as small reports, or send me the routine via email.

Class Participation: I expect you to do the assigned reading before coming to class.

Course description: The primary emphasis of the course is on the formulation, theory, and computer implementation of the FEM for linear partial differential equations (PDEs). In particular, we will discuss the construction of a variational form of governing equations, beginning with an ordinary differential equation (ODE) or PDE with the accompanying boundary and/or initial conditions. The governing equations we will consider model the behavior of physical systems and phenomena such as elasticity, heat conduction, advective/diffusive transport, incompressible viscous flow, and etc. We will cover the construction of various finite element approximations to the solution, how elements are designed and programmed, and how they are tested and verified for accuracy. Specific topics include examining why the finite element method usually provides a 'good' approximation, as well as in what cases it 'fails'. We will also examine various techniques for extending steady-state finite element formulations to transient problems (i.e. dynamics).

Tentative lecture schedule

Week	Date	Topics	Chapter from notes
1	8/30, 9/1	Introduction, overview	1, 2, Appendix
2	9/6, 9/8	Integral forms & Variational Methods	2
3–4	9/13, 9/15 9/20, 9/22	One dimensional BVPs	3
5–6	9/27, 9/29 10/4, 10/6	Multidimensional problems	4.1, 4.4
7–9	10/11[1], 10/13 10/18, 10/20 10/25, 10/27	Element design and programming concepts	4.5–4.7
10	11/1, 11/3	Error analysis	5.1
11	11/8, 11/10	Constrained media problems	5.2
12	11/15, 11/17	Advective/diffusive systems	6
13–14	11/22, 11/24[2] 11/29, 12/1	Transient analysis	7

[1] Fall break.
[2] Thanksgiving recess.