Finite Element Analysis
(ME 707)
Fall 2009

Tue, Thu 2:00-4:00PM
PSY B35

Course Description

The objective of this course is to teach the theoretical foundations and appropriate use of finite element methods. Through this class, students are expected to understand fundamentals of finite element analysis of solids, structures, and fluids.

Instructor

Dr. Katherine Yanhang Zhang
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Office Hours

Tue and Thu: 4:00PM-5:00PM. In addition to the regularly scheduled hours, the instructor is also available by appointment.

Textbook

A first course in finite element method (4th Edition), by Daryl L. Logan, 2007. ISBN 978-0-5-3455298-5

References

Finite element procedures. K.J. Bathe. Prentice Hall, 1996.
Concepts and applications of finite element analysis. R.D. Cook, D.S. Malkus, M.E. Plesha, and R.J. Witt, John Wiley & Sons, Inc, 4^{th} edition, 2002

Website

The course will use the Courseinfo web site (http://courseinfo.bu.edu). Course syllabus, homework assignments and solutions, lab assignments, and project descriptions, etc., will be posted on the web. Your grades will also be available through this site for your review.

Grading

Your grade in this course will be assessed by homework, project, and exams.

Homework + Lab	20%
Exam 1	30%
Exam 2	30%
Term Project	20%
Total:	100%

Exam Days (Tentative)

Exam 1: Oct. 15 (Thu)
Exam 2: Nov. 19(Thu)

Attendance

You are required to attend the class and are responsible for all materials and announcements in the class. Make-up class is only available in very special circumstances, such as illness.

Homework

Homework will be assigned weekly and will be due in one week. Some homework problems will require the use of finite element software. Discussions on the homework are encouraged. However, copying other people's homework will result in no credit.

Term project*

Every student is required to complete a term project. The objective of the project is that each student understands the theory and applies the understanding to analyze and solve problems. The term project should address a problem solution in solids, structures or fluid flows. At the end of the semester, each student will give a presentation. Project reports are due on Dec. 17th.

Lab*

Tutorials will be assigned weekly during the first half of the semester. The purpose of the tutorials is to help you learn finite element software – ANSYS. Associated with each tutorial, you will also be asked to solve one homework problem using ANSYS and compare the results. For those of you who know other finite element software such as ABAQUS, NASTRAN, etc., you may finish the problem with the software that you are familiar with.

Course Content

1. Introduction to finite element method. (0.5 week)
2. Formulation of the finite element method for linear static analysis of solids and structures (6 weeks)
    a. Stiffness method and potential energy approach.
    b. Truss, beam, and plate elements.
    c. Isoparametric elements
3. Formulation of the finite element method for nonlinear static analysis (3.5 weeks)

   a. Geometric nonlinearities
   b. Material nonlinearities
4. Formulation of the finite element method for fluid flows and heat transfer (2 weeks)
5. Introduction to Fluid-structure Interaction and Meshless Method (if time permitted)
6. Student presentation (1 week)

*More details about the subject will be forthcoming.

SYLLABUS FOR SPRING 2008*

(* subjected to change as semester proceeds)

WEEK	DATES	TOPICS	
1	1/17	Chapter 1,2	Introduction
2	1/22 1/24	Chapter 3	Stiffness method Truss element
3	1/29 1/31	Chapter 4,5	Beam element Frame
4	2/5 2/7	Chapter 6-8	Plane stress and plane strain stiffness equations Linear triangular element
5	2/12 2/14	Chapter 10	Isoparametric formulation – 2D Linear rectangular element
6	2/21	---	Review
7	2/26 2/28	**TEST NO. 1** ---	TEST NO. 1 ON 2/26 Quadratic element
8	3/4 3/6	Chapter 11	Isoparametric formulation – 3D Quadratic element
			SPRING BREAK
9	3/18 3/20	Chapter 12 ---	Plate bending element Integration algorithm
10	3/25 3/27	Chapter 13	FEA of fluid flow and heat transfer
11	4/1 4/3	Chapter 14	FEA of fluid flow and heat transfer
12	4/8 4/10	--- ---	FEA for nonlinear static analysis Review
13	4/15 4/17	**TEST NO. 2** ---	TEST NO. 2 ON 4/15 FEA for nonlinear static analysis
14	4/22 4/24	---	FEA for nonlinear static analysis Application of FEA in structural, fluid, and heat transfer problem
15	4/29 5/1	Student Presentation	

Project description: due 3/18/08
Project final report: due 05/08/2008