ES 128

COMPUTATIONAL SOLID AND STRUCTURAL MECHANICS

HARVARD JOHN A. PAULSON SCHOOL OF ENGINEERING AND APPLIED SCIENCES

Course Agenda

Lecture	Date	Theory	Abaqus	Homework
1	J-28	Introduction to ES128		
2	J-30	Trusses in 1D		
3	F-4	Trusses in 1D		
4	F-6	Trusses in 2D	Input Files	**HW1 assigned**
5	F-11	Strong and Weak Forms in 1D		
6	F-13	FEA for 1D Continuum Problems	Abaqus CAE	**HW1 due** / **HW2 assigned**
7	F-18	FEA for 1D Continuum Problems		
8	F-20	**Project Proposals**		**HW2 due** / **HW3 assigned**
9	F-25	Elements of 2D Linear Elasticity		
10	F-27		Scripting - Pre/Post processing	**HW3 due** / **HW4 assigned**
11	M-4	Review & Exercises		
12	M-6	**Midterm 1**		
13	M-11	Elements of 2D Linear Elasticity		
14	M-13	Elements of 2D Linear Elasticity	More scripting	**HW4 due**
15	M-18	**Spring Break**		
16	M-20	**Spring Break**		
17	M-25	FEA for 2D Elasticity Problems		
18	M-27		Finite deformations	**HW5 assigned**
19	A-1	**Intermediate Project Presentation**		**Project Report is due**
20	A-3	FEA for 2D Elasticity Problems	Plasticity and contact	**HW5 due** / **HW6 assigned**
21	A-8	FEA for frequency analysis		
22	A-10	FEA for dynamic problems		**HW6 due** / **HW7 assigned**
23	A-15		Dynamic simulations	
24	A-17		Dynamic simulations	**HW7 due**/**HW8 assigned**
25	A-22	Abaqus Review		
26	A-24	Review & Exercises		**HW8 due**
27	A-29	**Midterm 2**		
28	TBD	**Final Project Presentation**		**Final Report due**

Syllabus

Monday - Wednesday : 3:00 - 4:15 pm at MD221

Instructor: Katia Bertoldi - Pierce 311 - bertoldi@seas.harvard.edu

Teaching Fellow: Nick Vasios - Pierce 327 - vasios@g.harvard.edu

Office Hours: Katia Bertoldi - TBD / Nick Vasios - TBD

Textbook: A First Course in Finite Elements (Jacob Fish, Ted Belytschko)

ES128 is an introduction to computational techniques for the simulation of a large variety of engineered systems. The applicability to real-world engineering problems is stressed throughout the course. The course provides an introduction to finite element methods for analysis of steady-state and transient problems in solid, structural, fluid mechanics, and heat transfer. Modeling of problems and interpretation of numerical results. Implementation of simple MATLAB codes and use of existing general-purpose programs (ABAQUS). Final project addressing a significant problem arising in engineered systems.

Prerequisites: Engineering Sciences 120 or equivalent introduction to the mechanics of deformable materials.

Grading
- Homework (25%)
- Two Mid-Term Exams (25% each)
- Project (25%)

Homework
- Homework is mandatory in order to pass the course
- No late homework can be accepted, as the solutions will be posted on the day that homework is due
- All homework assignments will be posted on Wednesdays and are due on the following Wednesday (one week - unless other instructions are provided)
- All homework will be posted and submitted through Canvas
- Homework will consist of a combination of Paper, Matlab and Abaqus problems.
- Discussion and the exchange of ideas are essential to doing academic work. For assignments in this course, you are encouraged to consult with your classmates as you work on problem sets. However, after discussing with peers, make sure that you can work through the problem yourself and ensure that any answers you submit for evaluation are the result of your own efforts. In addition, you must cite any books, articles, websites, lectures, etc that have helped you with your work using appropriate citation practices. Similarly, you must list the names of students with whom you have collaborated on problem sets

Final Project
- A 5 minute report to the class regarding the plan of the project
- Groups of 2-3 people
- Projects should involve "serious" computation using ABAQUS/Matlab
- Intermediate presentation + Report
- A final presentation (15 minutes) + Report