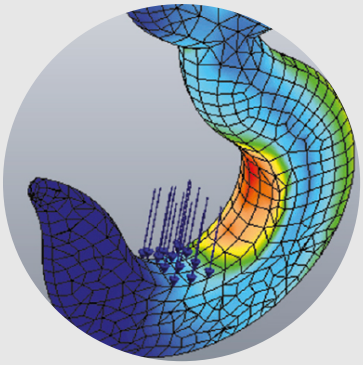

Finite Element Analysis and Computer Aided Engineering

MECH 332 - Spring 2022

3 Credits

Instructor Info

Masoud Masoumi

Office Hrs: Tues & Fri 1-2pm

Office: RLC 204

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Course Info

Tuesdays & Fridays

2-3:15pm

Classroom: RLC 208

Overview

Introduction to the theory of finite element methods; introduction to the variational calculus, onedimensional linear element, element matrices, direct stiffness method, coordinate systems, introduction to two-dimensional elements. Design process using CAE software. Solid modeling, finite element modeling and simulation. Selected problems in mechanical engineering will be modeled, designed and analyzed and solutions will be compared to those obtained from alternate methods.

Material

Required Text

- Introduction to Finite Element Analysis Using MATLAB and Abaqus by *Amar Khennane*, CRC Press, 1^{st} Edition (2013)

Other Texts

- A First Course in the Finite Element Method by *Daryl L. Logan*, Cengage Learning, 6^{th} Edition (2016)
- Finite Element Procedures by *Klaus-Jurgen Bathe* (2014) [link: http://web.mit.edu/kjb/www/Books/FEP_2nd_Edition_4th_Printing.pdf]

Grading Scheme

35%	Homework Assig. & Projects	A	Grade $\geq$ 93%
		A$^-$	90% $\leq$ Grade $<$ 93%
		B$^+$	87% $\leq$ Grade $<$ 90%
25%	Exam I	B	83% $\leq$ Grade $<$ 87%
		B$^-$	80% $\leq$ Grade $<$ 83%
		C$^+$	77% $\leq$ Grade $<$ 80%
25%	Exam II	C	73% $\leq$ Grade $<$ 77%
		C$^-$	70% $\leq$ Grade $<$ 73%
		D$^+$	65% $\leq$ Grade $<$ 70%
15%	Final Project	D	60% $\leq$ Grade $<$ 65%
		F	Grade $<$ 60%

Learning Outcomes

1. Understand the basic mathematical principles of finite element analysis
2. Model mechanical elements using solid modeling and finite element analysis
3. Perform computational finite element analysis using Abaqus - FEM software package
4. Write and present a report describing a CAD design project

Abaqus Projects

You are required to submit a report for each Abaqus project:

- Projects should be submitted on time. All the extension requests should be submitted before due date through an email.
- Late submissions will be penalized 10% for every 24 hours and won't be accepted after one week.
- For each project you need to submit the Abaqus file and a report.
- Reports should include the answers to each question directly. Report format may be different for different projects. All the graphs should be readable with axis clearly described and labeled. Legends should be included if applicable.

Software Access

Manhattan College provides access to a wide variety of software programs to support student instruction. To learn more about remote and on-campus software availability, please visit the following websites:

- Remote Computing for Students: https://remotely.manhattan.edu/
- List of Software Available in Computer Labs Remotely: https://manhattan.teamdynamix.com/TDClient/1932/Portal/KB/ArticleDet?ID=2768

FAQs

What if my schedule does not allow me to attend office hours?

You are more than welcome to make an appointment whenever you have a question or concern by contacting me via email.

What are the Abaqus projects?

The topic for the projects are related to the theory we covere in the lecture. However, the goal is to learn Abaqus (as a FEA software) to model the system. These projects will come with a step-by-step guideline to help you create the model, run the simulation, and get the results in Abaqus. These projects are individual projects.

What is the final project?

The topic for final project will be decided by students. This project is a group project focused on modeling a system/structure in Abaqus. It includes both writing a report and a giving a presentation by the group. Look at the syllabus for the deadlines related to the final project.

Is there any online resource that you suggest for this course?

A good resource covering finite element analysis is the lecture series by Prof. Bathe at https://www.youtube.com/playlist?list=PLD4017FC423EC3EB5 (old but really good)

Class Policy & Attendance

Due to the nature of the materials covered in this course, regular attendance is highly recommended. Students are required to fulfill all course requirements as detailed in the course syllabi for their registered courses. Implicit in these requirements is completion of all course assignments and attendance in all classes. Also, if I believe that a student's failure to attend class is substantially affecting his/her course grade, I am obligated to report the situation to the dean of the school in which the student is matriculated. The dean will address the situation with the student. In case you miss a class, it is your responsibility to keep up with the class work and be informed of all announcements in class such as homework assignments, quizzes, etc. Cell phones and all other forms of electronic communication devices, if carried into the classroom, must be turned off. The use of computers and other electronic devices during class is restricted to classroom activities and course applications.

Academic Integrity

The college Community Standards & Student Code of Conduct is central to the ideals of this course. Students are expected to be independently familiar with the code and to recognize that their work in the course is to be their own original work that truthfully represents the time and effort applied. Violations of the Academic Policies of the Community Standards & Student Code of Conduct are most serious and will be handled in a manner that fully represents the extent of the Code and that befits the seriousness of its violation. See the code here https://inside.manhattan.edu/student-life/dean-of-students/code-conduct.php#academicintegrity for more information.

Diversity and Inclusivity

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender identities, national origins, religious affiliations, sexual orientations, ability, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Accommodations for Students with Special Needs

If you are a student with learning needs that require special accommodation, contact the Accommodation Administrator in Specialized Resource Center (SRC) located in Thomas Hall, Room 3.15 as soon as possible to make an appointment to discuss your special needs. Once your Academic Adjustment/ Auxiliary Form is approved, please meet with me during my office hours and bring the form. You can find more information about SRC and the procedure on their website https://inside.manhattan.edu/academic-resources/specialized-resource-center/index.php.

Academic Assistance

The Center for Academic Success (CAS) has two locations - the Learning Commons & the Leo Learning Center. These offices, conveniently spread across campus, will provide students with a quiet space to study with a peer tutor, or engage in small group study sessions. The services offered include individual peer tutoring in most 100-200 level and select 300-600 level courses. All services are free of charge. Appointments are preferred but drop-ins are also welcome. To make an appointment contact the CAS at (718) 862-7414, email success@manhattan.edu or visit Thomas Hall, 3^{rd} floor. For more information please visit their website at https://inside.manhattan.edu/academic-resources/center-for-academic-success/index.php

Class Schedule

The course will tentatively follow this schedule.
All Tuesday classes are lectures and all Friday classes are labs (working with ABAQUS), except for Week 14th, where both sessions are lab sessions.

Week	Topic	Book chapter	Date
Week 1	Introduction	1	Jan 21st
Week 2	Bar Element	2	Jan 25th
	Analysis of a Bar		Jan 28th
Week 3	Truss Element	2	Feb 1st
	Analysis of a Truss		Feb 4th
Week 4	Beam Element	3	Feb 8th
	Analysis of a Beam		Feb 11th
Week 5	Beam Element	3	Feb 15th
	Creating Geometry		Feb 18th
Week 6	Beam-Column Element	4	Feb 22nd
	Mat. and Sec. Properties		Feb 25th
Week 7	Exam Review		Mar 1st
	Midterm Exam		Mar 4th
Week 8	Stress-Strain Analysis	5	Mar 8th
	Creating Assembly		Mar 11th
	Spring Break		
Week 9	Weighted Residual Methods	6	Mar 22nd
	Step Definition & Loads - Final Project Proposal Due		Mar 25th
Week 10	Finite Element Approximation	7	Mar 29th
	Partitioning & Meshing		Apr 1st
Week 11	Final Project Review		Apr 5th
	Pipe Creep		Apr 8th
Week 12[E]	Finite Element Approximation	7	Apr 12th
Week 13	Finite Element Approximation	7	Apr 19th
	Thermal Analysis		Apr 22nd
Week 14	Composite Beam		Apr 26th
	Final Project		Apr 29th
Week 15	Project Presentation		May 3rd
	Final Review		May 6th
Week 16	Final Exam	-	

[E] Easter Holiday - No class on Friday.