ME 5310 Finite Element Methods
Spring 2017

Instructor: Endel V. Iarve

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Office Hours: Tuesday and Thursday after class

Section Information: ME 5310-001, 002 (online)

Time and Place of Class Meetings: Tuesday and Thursday, 9.30-10.50am, *WH 404*

Description of Course Content: Finite element method in the study of the static response of structures and of continua; applications to field problems; analytical methods emphasized, and digital computer application undertaken.

Student Learning Outcomes: After the completion of the course the student is expected to understand the basics of the finite element method, element development, FEM methodology, and be able to perform FE analysis of simple elastic problems, including evaluation of the solution accuracy.

Required Textbooks and Other Course Materials: *Concepts and Applications of Finite Element Analysis*, Robert D. Cook, et al, 4th edition, John Wiley, 2002.

Descriptions of major assignments and examinations:

1. **Homework**

Homework will consist of two parts: analytical problems and modeling exercises. The latter are required but will not be included in the homework grade. We will discuss the modeling portion in class. Satisfactory completion of the modeling exercises will increase your final grade for the course if you are on the fence between grade levels.

Submit your homework unfolded, stapled in the upper left corner, with a cover sheet that contains the following in the upper 1/4 of the page:

Student Name - Last, First

Course No. and Instructor (*ME 5310, Instructor Endel V. Iarve*)

Date

Off-campus location if applicable

Course Assignment Number and, if applicable, text problem number(s).

Each assignment should be considered an engineering task and documented accordingly. State the problem to be solved and make a good sketch to illustrate it. Work neatly, using one side of the paper

only. Number, date, and put your initials in the upper right hand corner of each page. When the assignment calls for computer solution of problems, be sure to use the computer generated output to support your results and conclusions, not as a substitute for a report of your effort.

Provide a problem statement indicating what is known and what is to be found. Include a good sketch that shows dimensions, units, materials and their properties, loadings, supports, axis systems used, and when appropriate, member cross section shapes and dimensions.

2. Project

Assigned around midterm

The project will be defined around midterm and will consist of one or more FEM modeling problems. Student will be required to conduct mesh refinement studies and other accuracy assessments to verify the correctness of the analysis results. The project must be documented in a written report. Alternatively, the student may write, test, demonstrate, and document an original finite element computer program, to demonstrate a thorough knowledge of the necessary theoretical, mathematical, and numerical operations. The computer program must include arbitrarily-shaped (parametric) finite elements evaluated using numerical quadrature. Students interested in the second option are encouraged to identify themselves early on to discuss logistical issues and access to programming tools.

3. Quiz

Most lectures will include a short 10 minute quiz. While not directly entering into final grade calculation these quizzes will be taken into account while determining midterm and final score. They will also use as indirect attendance indicators.

4. Software

FEM software package ABAQUS Educational Edition will be available in MAE CAD Lab.

It is highly recommended to download and install on your personal computers a free ABAQUS Student Edition copy from the website http://academy.3ds.com/jp/software/simulia/abaqus-student-edition. The Student and Educational Editions are identical with exception of the limit number of nodes allowed. More importantly they both come with a complete set of user and theoretical manuals. Install the software and follow the getting started links.

5. Schedules

In order to keep the homework problem flow in close coordination we'll establish the following schedules:

On-campus students: unless otherwise noted, homework is due at the beginning of the class period, one week after it is assigned.

Streaming video students use the same schedule as the on campus students.

I have some flexibility on these schedules, but because of the class size, not a lot. Don't let the dog eat your homework more than once or twice during the semester.

6. Exams

The midterm exam will be in class, closed book, open notes, NO electronic devices.

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Make-up Exam Policy: There will be NO make-up exams except in extraordinary circumstances. Missed exams will receive a grade of zero unless the student has an excused absence

Attendance: Lecture attendance will not be recorded but you are expected to attend every class and are responsible for information communicated during class times, including lecture material, assignments, and class schedule changes. The attendance will be indirectly evaluated by quizzes (see section 4) as well as by sporadic direct check.

Grading: Homework - 25%, Midterm Exam - 25%, Final Exam- 25%, Project-25%; A≥90%, B≥80%, C≥70%,D≥60% of full credit

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:
The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding*

Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at https://www.uta.edu/conduct/.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week: for semester-long courses**,** a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located directly in front of the class door while exiting the classroom. When exiting the building during an emergency, one should

never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.
(http://www.uta.edu/police/Evacuation Procedures.pdf)

Course Schedule

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –Endel V. Iarve

Class	Week	Topic	Read before class
1	1	Introduction	1.1-1.6
2	2	1D Elements	2.1,2.2
3		2D Beam Element	2.3
4	3	Element Transformations	2.4,2.5
5, TJ31		Computational Aspects of FEM	2.6-2.8
6	4	Variational Methods	4.1-4.3, 4.5-4.7
7		Weak Formulation. Galerkin Method	5.1-5.6
8	5	ABAQUS Review session	
9		Fundamentals of Solid Mechanics	3.1, 4.4
10	6	Constant Strain Triangle - CST	3.2-3.4
11		Four Node Quadrilateral - Q4	3.6
12	7	Element Pathology and Remedies	3.6, 13.6
13,RF28		Axisymmetric Problems	14.1,14.2
14	8	Midterm exam	
15		Isoparametric Elements	6.1-6.3
16	9	Numerical Integration	6.3-6.4, 7.4
17		Isoparametric Element Examples	16
18	10	3D Solid elements	17
19		Basic Element Improvement	6.6-6.8
20,RM30	11	Modeling, Substructuring, Symmetry, Constraints	10.1-10.15
21		ABAQUS Review Session	
22	12	ABAQUS Review Session	15.1-15.3
23		Plate Examples	15.6
24	13	Shell Element	16.1-16.2
25		Structural Elements Review	
26	14	Structural Dynamics	11.1-11.4
27	15	Structural Dynamics	11.5,11.16-11.18
28,RA27		Nonlinear Problems	17.1,17.2
29	16	Nonlinear Problems	17.8,18.1,18.2
		Final Exam	

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php

Library Home Page library.uta.edu

Resources for Students

Academic Help

Academic Plaza Consultation Services library.uta.edu/academic-plaza

Ask Us ask.uta.edu/

Library Tutorials library.uta.edu/how-to

Subject and Course Research Guides libguides.uta.edu

Subject Librarians library.uta.edu/subject-librarians

Resources

A to Z List of Library Databases libguides.uta.edu/az.php

Course Reserves pulse.uta.edu/vwebv/enterCourseReserve.do

FabLab fablab.uta.edu/

Special Collections library.uta.edu/special-collections

Study Room Reservations openroom.uta.edu/

Teaching & Learning Services for Faculty

Copyright Consultation library-sc@listserv.uta.edu

Course Research Guide Development, Andy Herzog amherzog@uta.edu or your subject librarian

Data Visualization Instruction, Peace Ossom-Williamson peace@uta.edu

Digital Humanities Instruction, Rafia Mirza rafia@uta.edu

Graduate Student Research Skills Instruction, Andy Herzog amherzog@uta.edu or your subject librarian

Project or Problem-Based Instruction, Gretchen Trkay gtrkay@uta.edu

Undergraduate Research Skills Instruction, Gretchen Trkay gtrkay@uta.edu or your subject librarian.