

Finite Element Analysis & Design

EML 4507 Section 167A

Class Periods: MWF, period 2, and 8:30 AM–9:20 AM (ET)

Location: Zoom (please use links in Canvas)

Academic Term: Spring 2024

Instructor:

Dr. Xin Tang; xin.tang@ufl.edu

Lab website: <https://quangdikebar.wixsite.com/tang-lab>

Office: 465 Wertheim Building

Office Hours: WF (9:20 AM–10:20 AM), other times by email appointment and via Zoom (links are in Canvas)

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website or the zoom linked generated by TA

- To be announced, MWF 9:20 AM–10:20 AM (ET)

Course Description

3 credit hours

Course Pre-Requisites / Co-Requisites

Elementary Differential Equations, Linear Algebra, or equivalent

Course Objectives

The overarching objective of our course is to teach how to design, analyze, and optimize structural components of machine systems in nature using finite element method (FEM). The course exposes students to (1) analytical and numerical methods for computing displacement, stresses, and strains in 2D and 3D structures, (2) systematic use of finite element software ABAQUS for static structural analysis and the application of design, and (3) failure criteria to ensure that mechanical components can carry the design load without failure. Authentic cross-disciplinary science and engineering research topics, will be presented by the invited speakers to broaden students' horizon in the context of computational simulation and mechanics modelling, such as brain science, machine learning, artificial intelligence, drug discovery, mechanobiology, and multiplexed imaging. Another important area of the course is to make the students recognize the importance of active self-education and life-long learning to enhance their career.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a	Medium

collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

Required Textbooks and Software

- Introduction to Finite Element Analysis and Design
Nam H. Kim, Bhavani V. Sankar, and Ashok V. Kumar
John Wiley & Sons, Ltd., 2018
ISBN: 9781119078722

Recommended Materials

A number of additional excellent books and journal papers will be introduced in our class.

Course Schedule

Week 1:	Introduction and Math Prelim and Direct Method
Week 2:	Direct Method
Week 3:	Uniaxial Bar and Truss Elements
Week 4:	Beam Finite Element-1
Week 5:	Beam Finite Element-2
Week 6:	Beam Finite Element-3
Week 7:	Review of Solid Mechanics
Week 8:	Plane Solid Elements (CST)-1
Week 9:	Plane Solid Elements (CST)-2
Week 10:	Plane Solid Elements (Rectangular element)
Week 11:	Interdisciplinary Topics-1
Week 12:	Plane Solid Elements (Isoparametric element)
Week 13:	Interdisciplinary Topics-2
Week 14:	Examples of problem solving
Week 15:	Final Review

Attendance Policy, Class Expectations, and Make-Up Policy

All students are expected to show up on time for class. Please turn off all cell phones and electronic devices prior to the start of class. Please do not bring food to class. No late homework assignments will be accepted, but 2 homeworks with the lowest scores will be dropped. Makeup exams are not allowed. If you cannot attend an exam or cannot meet a due date, you must contact the instructor prior to the exam or due date.

It is expected that this course will require at least 15 hours of effort per week when you consider time spent for lectures, reading assignments, homework, and re-writing of your class notes. I also expect that you will attend every lecture. If you cannot attend a lecture, please notify me prior to class unless in the case of an unanticipated emergency. I strongly recommend that you implement the “Five Times Strategy (recommended by Prof. Mark Shaplak)” for learning in this class. This requires that you cover the course material at least 5 times before exams. The first time that you cover the material is when you perform your reading assignment before class. The second time that you cover the material is during lecture. The third time that you cover the material is when you re-write your “lecture set” of notes that includes material from lecture and the reading assignments, including all derivations and your additions. The fourth time that you cover the material is when you do your homework assignments. Finally, the fifth time that you cover the material is when you study for your exams. This technique will help you master the material and also will provide you with a comprehensive set of notes to potentially teach.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (10)	100 each	20%
Quizzes (6)	100 each	10%
Midterm Exam (2)	100	30%
Final Exam (1)	100	20%
Projects (4)	100	20%
		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor are available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.