

ME 4189-A
Mechanical Vibrations
Fall 2026

Instructor: Dr. Alper Erturk

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Office: Love Building – Room 113; **Phone:** 404-385-1394

Office hours: TBD in person or virtual – if you prefer to connect via Zoom, send me an email so we can arrange, and you can email for additional appointments

Homework grader: TBD

Prerequisites: ME 2202 Dynamics of Rigid Bodies & MATH 2403 Differential Equations (or equivalent)

Webpage: canvas.gatech.edu

Course description

- Single- and multi-degree-of-freedom systems, as well as continuous systems, are analyzed for their vibrational response characteristics using both exact and approximate methods.

Course objectives

- Develop an ability to model and analyze free vibration (response to initial conditions) of single-degree-of-freedom (SDOF) systems with various damping types
- Learn methods of damping identification and various damping types (e.g. viscous damping, Coulomb damping, etc.)
- Develop an ability to model and analyze forced vibration of SDOF systems under harmonic and generalized periodic excitations
- Develop an ability to model and analyze vibration of SDOF systems under non-periodic excitation forms
- Learn methods of modeling and analyzing 2-DOF systems and concepts (modal analysis, beat phenomenon, vibration absorber design, system with a rigid body mode)
- Develop an ability to model and analyze free and forced vibration of generalized multi-DOF (MDOF) systems (response to initial conditions, forced vibration by matrix inversion modal analysis)
- Develop a basic understanding of modeling and analyzing continuous systems with approximate and exact methods

Required course materials:

- There is no required textbook if you follow the lectures and take notes, but the book we will most closely follow is “Fundamentals of Vibrations” by L. Meirovitch (Waveland Pr., 2010, or McGraw-Hill, 2001). Other typical books for a first course on linear vibrations are “Principles and Techniques of Vibrations” by L. Meirovitch, “Mechanical Vibrations” by S. Rao, “Theory of Vibration with Applications” by W. Thomson, “Engineering Vibration” by D. J. Inman, or “Mechanical and Structural Vibrations” by J. Ginsberg, among others.

Exams

- Exams are proctored in person, closed book and closed notes, but you are allowed to prepare and refer to a two-sided letter size (8.5x11-inch) sheet.
- The formula sheet must be your own (handwritten or typeset/printed) and you must turn it in with your test.
- No computers or communication devices should be in use.
- You may use a pocket calculator as needed.
- If you miss an exam without a valid and documented excuse, no make-up exam will be given.

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Homework assignments

- Homework assignments and solutions will be posted via Canvas.
- Homework assignments must be submitted in pdf format as a single file (make sure it is legible). Please combine your solution, computer codes, and plotted outputs into a single pdf file.
- Do not attempt to submit multiple pdf files for a single homework assignment. Submissions in other formats (jpeg etc.) or as multiple files will not be graded.
- Please use the following file naming convention for consistency in your submissions: hw#_lastname_firstname.pdf
- You are allowed to collaborate on homework assignments, discuss and exchange ideas with other students, but you must turn in your own work.
- Complete solutions and neatness are expected in your homework papers. Lack of neatness may negatively affect your homework grade.
- Use of a computer package (e.g. MATLAB) may be required in most/all homework assignments (for time series or frequency response plotting, eigenvalue problem solution, etc.).

Grading policy and weighting

- Exam 1: 25% (TBD)
- Exam 2: 25% (TBD)
- Final exam (cumulative): 35% (TBD)
- Homework: 15%
- The following letter grades are *guaranteed*: $x \geq 90\%$ is an A; $90\% > x \geq 80\%$ is a B; $80\% > x \geq 70\%$ is a C; $70\% > x \geq 60\%$ is a D (*I usually help if you are near the limits, and I do not "curve" unless it is to your advantage*)

Canvas

- Assignments and announcements will be posted on canvas (canvas.gatech.edu).
- It is your responsibility to check canvas and your e-mails regularly for the assignments, announcements, and updates.
- Homework and exam solutions will also be posted on canvas.

Attendance policy

- I highly encourage you to attend the lectures and to participate. Usually there is a dramatic difference in the exam performance between students who regularly attend class and those who do not.

Academic integrity

- Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.
- Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Student-faculty expectations agreement

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- At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Collaboration and group work

- You are allowed to work in groups on all homework and out-of-class assignments (and you may use my solutions), but any work you turn in must be written in your own hand. In-class exams are to be your own work.

Extensions, late assignments, and re-scheduled/missed exams

- Late homework will be penalized accordingly. Make-up exams are given for illness, approved Institute activities or religious observances

Accommodations for students with disabilities

- If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Let me know how I can help.