

ASEN 5022: DYNAMICS OF AEROSPACE STRUCTURES

SPRING 2021

Class meetings: Tue/Thr 1:15 AM - 2:30 PM over Zoom

Class mode: Remote/online

Instructor:

Alireza Doostan

Office: AERO 356

Tel: 2-7572

E-mail: doostan@colorado.edu

Office hours: Tue 2:45 - 4:00 PM and Thr 2:45 - 4:00 PM, otherwise by appointment.

Teaching Assistant:

Mary Bastawrous

E-mail: Mary.Bastawrous@colorado.edu

Office hours: Wed 1:00 – 2:00 PM

Class Zoom link: Zoom

Prerequisite: ASEN 5012, 5227 or equivalent. Recommended: MATH 313

Textbook: M. G eradin and D. Rixen, Mechanical Vibrations: Theory And Application To Structural Dynamics, 3rd edition, 2015.

Reference book: R. Craig and A. Kurdila, Fundamentals of structural dynamics, 2nd edition, 2011.

Grading: Homework (20%), two in-class mid-term exams (50%), and an in-class final exam or final project (30%)

Exam dates (tentative):

- Mid-term Exam 1: Thursday, February 25
- Mid-term Exam 2: Thursday, April 1
- Final Exam: Sunday, May 2, 4:30 - 7:00 PM over Zoom

Course content:

1. Review of dynamics of single-degree-of-freedom systems

2. Analytical dynamics of discrete systems
 - (a) Principle of virtual work
 - (b) Hamilton's principle for conservative systems
 - (c) Lagrange equations of motion
3. Undamped vibration of n-degree-of-freedom systems
 - (a) Linear vibration about an equilibrium configuration
 - (b) Normal modes of vibration
 - (c) Free vibration and analysis under forced harmonic and external loadings
4. Damped vibration of n-degree-of-freedom systems
 - (a) Normal eigensolutions
 - (b) Forced harmonic response for lightly damped systems
 - (c) State-space formulation of viscously damped systems
5. Dynamics of continuous systems
 - (a) Formulation of 1D continuous systems
 - (b) Continuous eigenproblem
6. Numerical methods in dynamical systems
 - (a) Displacement, Rayleigh-Ritz, and Finite Element methods
 - (b) Direct time integration methods
 - (c) Numerical solution of eigenvalue problems
7. Introduction to random vibration (if time permits)

SOME UNIVERSITY POLICIES

CLASSROOM BEHAVIOR

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

REQUIREMENTS FOR COVID-19

As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements, and public health orders in place to reduce the risk of spreading infectious disease. Required safety measures at CU Boulder relevant to the classroom setting include:

- maintain 6-foot distancing when possible,
- wear a face covering in public indoor spaces and outdoors while on campus consistent with state and county health orders,
- clean local work area,
- practice hand hygiene,
- follow public health orders, and
- if sick and you live off campus, do not come onto campus (unless instructed by a CU Healthcare professional), or if you live on-campus, please alert [CU Boulder Medical Services](#).

Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to [Student Conduct and Conflict Resolution](#). For more information, see the policies on [COVID-19 Health and Safety](#) and [classroom behavior](#) and the [Student Code of Conduct](#). If you require accommodation because a disability prevents you from fulfilling these safety measures, please see the “Accommodation for Disabilities” statement on this syllabus.

All students who are new to campus must complete the [COVID-19 Student Health and Expectations Course](#). Before coming to campus each day, all students are required to complete the [Buff Pass](#).

Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home. In this class, if you are sick or quarantined, please alert the instructor by email. Please note that the instructor does not require you state the nature of your illness.

ACCOMMODATION FOR DISABILITIES

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

PREFERRED STUDENT NAMES AND PRONOUNS

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those

preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

HONOR CODE

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT AND/OR RELATED RETALIATION

The University of Colorado Boulder (CU Boulder) is committed to fostering an inclusive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#).

Please know that faculty and graduate instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

RELIGIOUS HOLIDAYS

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance.

See the [campus policy regarding religious observances](#) for full details.