



SAN DIEGO STATE
UNIVERSITY

AE 410 “AEROSPACE STRUCTURAL DYNAMICS” (3 credits) Syllabus and Class Policy

Fall 2012

Tuesdays and Thursdays, 9:30 to 10:45 AM
North Education, Room NE-173
San Diego State University

Instructor

Dr. Luciano Demasi
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Please make sure to include the course name, AE410, in any email correspondence.

Office Hours

Tuesday and Thursday 1:45-2:45PM

Textbook

Singiresu S. Rao, *Mechanical Vibrations*, Pearson Prentice Hall. ISBN 0-13-048987-5



Other useful books

Dynamic analysis using the Finite Element Method

Bathe K. J., *Finite Element Procedures in Engineering Analysis*, Prentice-Hall civil engineering and engineering mechanics series. Englewood Cliffs, N. J.: Prentice-Hall, 1982

Vibrations and structural dynamics

Ginsberg J. H., *Mechanical and Structural Vibrations: theory and applications*, New York: Wiley

Thomson W. T. And Dahleh M. D., *Theory of vibration with applications*, Upper Saddle River, N. J.: Prentice Hall, 1998

Donaldson B. K., *Introduction to Structural Dynamics*, Cambridge aerospace series. Cambridge: Cambridge University Press.

Introduction to Aeroelasticity

Hodges D. H. And Pierce G. A., *Introduction to Structural Dynamics and Aeroelasticity*, Cambridge aerospace series, 15. Cambridge, [England]: Cambridge University Press.

Prerequisites

Credit or concurrent registration in [Aerospace Engineering 310](#) (Aerospace Structural Analysis)

Students are expected to have basic understanding of kinematics and dynamics of rigid bodies (Rober W. Soutas-Little Daniel J. Inman, *Engineering Mechanics – Dynamics*, Prentice Hall, is a good example).

Course objectives

The objective of this course is to introduce the student to the aerospace structural dynamics. The material presented in this course will provide the foundation for pursuing other courses such as Vibration of Elastic Solids (EM611) and aeroelasticity (EM731).

Course Outline

- Fundamental of Vibration
- Free Vibration of Single Degree of Freedom Systems
- Harmonically Excited Vibration
- Vibration Under General Forcing Conditions
- Two degree and Multidegree of Freedom Systems
- Natural Frequencies and Mode Shapes
- Continuous Systems



- Numerical Integration Methods in Vibrations Analysis (1)
- Nonlinear Vibration (1)
- Calculation of Frequencies and Modes with the Software NASTRAN (1)
- Vibration Analysis of a Realistic Aerospace Vehicle with the software NASTRAN (1)
- Dynamic stability (1)
- Introduction to aeroelasticity (1)

(1): The content of the course may change depending on students' interests and time constraints

Course Outcomes

At the close of AE410 you should be able to...

1. Conduct a simplified analysis of one-degree-of-freedom and multi-degree-of-freedom systems.
2. Calculate the mass matrix, stiffness matrix and the modes of the systems analyzed in the course.
3. Draw free-body diagrams and write the equations of motion
4. Perform a transient response of a system similar to the ones analyzed in the class or in the homeworks.
5. Describe and summarize the main concepts of the subjects covered in the course with the inclusion of examples.
6. Solve problems similar to the ones discussed in the class and/or assigned in the homeworks.

Grading

In order to acknowledge achievements and monitor progress, the Department needs a realistic and meaningful system for grading performance. The University and the professional community expect the Department to maintain standards that reflect its reputation as one of the foremost programs of its type in the country. According to the University's Graduate Bulletin,

A means outstanding achievement; available for only the highest accomplishment;

B means praiseworthy performance; definitely above average;

C means average; awarded for satisfactory performance.



In general, professors in the department award "A" grades to acknowledge achievements that go beyond specified course requirements and criteria. By its very nature, this type of performance cannot always be spelled out clearly in advance. "A"s are reserved for special efforts that exceed expectations by demonstrating exceptional creativity, boldness, commitment, ingenuity, or elegance.

Grading Factors

| Assignment/Activity | % of final grade |
|---|------------------|
| Homework. An homework is an assignment that requires several days to be completed. <u>Collaboration is not allowed.</u> The homework must be on the desk of the classroom <u>before the lecture starts</u> on the due date. <u>Late homework will be accepted, with penalty of 20%, on the due date only.</u> Quality of the presentation of the results (clarity, easy to follow etc.) is crucial. Homework completed and <u>given to the instructor a lecture earlier</u> than the due date (for example on Tuesday instead of the due date of Thursday) will <u>receive up to 5% bonus.</u> | 30 |
| Exams 1,2 and final exam (or final project). The students will be asked to describe the main concepts of some subjects covered in the first part of the course and/or to solve some problems similar to the ones analyzed in the class or homework before the mid-term exam date. Quality of the presentation of the results (clarity, easy to follow etc.) is crucial. | 70 |
| Handwritten notes. The students have the choice to attach a copy (when the homework is completed) of the <u>at-home improved handwritten</u> notes of the material covered in the class. If the notes are very detailed and well done the students will <u>receive up to 5% bonus.</u> The best notes may be published on blackboard. This bonus will be used to increase the grade of the homework. | BONUS |
| TOTAL | 100 |

Every assignment or activity will be graded in a scale of 100 points.

Reported Final Grades

A = 90 or higher

B = 80 or higher (but less than 90)

C = 70 or higher (but less than 80)

D = 60 or higher (but less than 70)

The instructor reserves the right to raise or lower the lower limit of each grade range such that division between letter grades occurs at large gaps in the grade spectrum.



Minor adjustments to avoid grades being decided by a fraction of a point may be adopted.

If you feel a mistake was made in grading any material involving (1) points not added or not recorded properly, (2) points taken-off for an answer that is not 100% correct, or (3) for given partial credit, please talk to the instructor either through e-mail or in person **during the office hours**.

Participation (classes)

Please do not come late to class sessions as it detracts from the learning experience of everyone involved. Attendance is mandatory.

Class participation will be used in deciding borderline grades.

Accommodations for Students with Disabilities

Students with disabilities who need support services are encouraged to notify the instructor as soon as possible. This can be done confidentially via email or by phone (see instructor contact information).

Academic honesty

All students admitted to SDSU have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at SDSU and to be honest in all work submitted and exams taken in this class and all others

Plagiarism

Plagiarism consists of passing off as yours the work that belongs to someone else. As such, you will be committing plagiarism if you present someone else's work as your own, even with the other person's consent.

Miscellaneous

Taking pictures is not allowed.

No electronic devices (for example cell phones, cameras etc.) are allowed in the class. **The students must turn them off.** The use of laptop is allowed in the classroom for the only purpose of taking notes. Any other laptop use (e.g. checking emails or searching the web) must be postponed until the class ends to avoid distractions for the other students. A violator of this rule will be asked to turn off the computer.

Submitting copy of a homework prepared by somebody else is considered cheating.



Submitting a project which is copied in full or in part from other students' work is considered plagiarism.

Collaboration on a project or homework is not allowed unless specifically allowed by the instructor when the project/homework is assigned.

