ASEN 4123 Vibration Analysis
Fall 2019

Courtesy: 3B Associates

Course Description:

This course provides an introduction to the principles and techniques of structural dynamics, covering the basic theory of vibrations including modeling and analysis methods. While the bulk of the course will focus on analytical techniques, computational, and experimental analysis will also be covered. The course is suitable for students planning to pursue the subject further in either an academic or industrial setting. It is also useful for students interested in integrating vibration analysis into their system engineering activities for both aerospace and mechanical engineering applications. Some insights on the role of atomic-scale vibrations in materials science will also be provided.

Instructor: Prof. Mahmoud I. Hussein, ECAE 194, UCB 429, Smead Aerospace Engineering Sciences, University of Colorado Boulder, CO 80309; Tel: (303) 492-3177; Email: mih@colorado.edu

Office Hours: Mondays and Fridays 4:30-5:45 pm

Textbook: Rao, Singiresu S., *Mechanical Vibrations*, 6th Edition, Addison-Wesley, 2016

Lectures: Mondays and Fridays 4:30-5:45 pm AERO 232

Homework: There will be roughly 4-5 homework sets in the semester

Project: Term project will be a central activity in the course. It will involve analysis and design of a mechanical component from a vibrations perspective. Project will involve analytical, computational, and experimental work. Each project team will consist of two students (with some exceptions possible). Final results and conclusions will be reported in the form of a conference-style paper and presentation. The new PILOT facilities in the new Smead Aerospace building will be utilized for the project.

Examinations: Two in-class 1.5 hour examinations will be given, one around the middle of the semester and one at the end of the semester. All examinations are closed-book. One double-sided sheet of notes will be permitted for reference.

Grading:
Homework ……. 10%
Project …… 35%
First Exam ……. 25%
Second Exam ……. 30%

Prerequisite: ASEN 3112 or equivalent (exceptions are possible; contact instructor for details)

Preliminary Course Outline

- Introduction to Vibrations
- Single Degree-of-freedom Systems – Free Vibrations
- Single Degree-of-freedom Systems – Force Vibrations
- Two Degree-of-freedom Systems – Free/Forced Vibrations
- Modal Analysis of Multi Degree-of-freedom Systems – Undamped Systems
- Modal Analysis of Multi Degree-of-freedom Systems – Damped Systems
- Lagrange's Equations
- Continuous Systems – Rods and Beams
- Nonlinear vibrations
- Vibration Analysis by Finite Elements
- Computational Vibration Analysis
- Experimental Vibration Analysis