San José State University
Department of Mechanical Engineering
ME 147 – Dynamic Systems Vibration and Control
Fall 2016

Instructor: **Dr. A. Rahimi**
Lecture: **M-W 7:30 – 8:45 PM, Class Code: 42860, Section-2**
Classroom: **CL 234**
Email: **arz_rahimi@yahoo.com**
Office Hours: **M-W 5:15 – 5:45 PM**
Office Location: **Eng 348**
Prerequisite: **Grade of "C-" or better in ME130 (Undergraduate Students)**
"Students must turn in an unofficial transcript with the prerequisites highlighted by the second class period, or they will be dropped from the class."

Course Description

Introduction to dynamic systems vibration and control including problem formulation, mathematical representation, and analysis. Damped and Undamped free and forced vibrations of single and multi-degree of freedom systems. Transient and forced response analysis. Vibration control and isolation. Discrete and continuous mass system formulation and dynamic response analysis. Dynamic system transfer function determination. Transient and Frequency response analysis. Stability Criterion. State Variable method. Feedback and feed forward compensation. Emphasis on engineering problems involving analysis & design.

Required Text

Dynamic Systems Vibration and Control, By Fred Barez, Fall 2016

References

Fundamentals of Mechanical Vibrations by Kelly & Control Systems Engineering by Nise

Assignments and Grading Policy

Homework: **30%**
Midterm: **30%**
Final: **40%**
Homework will be assigned weekly on each Wednesday and is due on the next Wednesday.
Homework will be graded and retuned to students with the solution in the following week.

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation, studying or course related activities including but not limited to internships, labs, clinical practical. Other course structures will have equivalent workload expectations as described in the syllabus.

Course Goals

1. To learn fundamental concepts of mechanical vibration and Control Systems.
2. To learn fundamental concepts of vibrations & control for the linear systems.
3. To learn fundamental concepts of discrete models of continuous dynamic systems.
4. To learn applications of analytical and numerical methods to solve problems in vibrations and control design of dynamic systems.
5. To develop numerical analysis solutions for linear mechanical systems.

Student Learning Objectives

1. To fully understand the method of solution for dynamic system vibrations with one degree of freedom: damp and undammed systems.
2. To be able to apply techniques for modeling of dynamic systems and controller design applying classical and modern control approaches.
3. To be able to apply techniques for analyzing stability of the linear dynamic systems.
4. To be able to apply techniques for designing controllers for dynamic systems.
5. To know how to deal with modeling of mechanical systems for vibrations and Control.
6. To be able to use numerical methods to solve control systems and vibration problems.

Classroom Protocol

Students should attend all classes and take class notes to support their reading assignments. No use of Cell phone is allowed in the class during the instruction.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic calendar web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Last Day to Drop: Tuesday 09/06/2016
Last Day to Add: Tuesday 09/13/2016
Holidays: Monday 09/05/2016 (Labor Day)
Friday 11/11/2016 (Veteran's Day)
Thursday 11/24/2016 & Friday 11/25/2016 (Thanksgiving Holiday)
Last Day of Instructions: Wednesday 12/12/2016

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University's Academic Integrity policy, located at http://www.sjsu.edu/senate/S07-2.htm, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sa.sjsu.edu/judicial_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy S07-2 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the Disability Resource Center (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

ME 147, Dynamic Systems Vibration and Control – Course Outline

Week	Date	Lecture Topics for Advanced Reading
1	Aug 24, 2016	**Part-1 Mechanical Vibrations:** Principles of Mechanics – Introduction to Vibrations – Equation of Motion
2	Aug 29-31, 2016	Natural Circular Frequency – Period of Oscillations – Energy Methods – Vibration of Physical Systems
3	Sep 5*-7, 2016	Free and Forced Vibrations – Undamped and Damped Vibrations of Particles – Single Degree of Freedom System (SDOF) ***No Class on Monday Sep 5: Labor Day Holiday**
4	Sep 12-14, 2016	Magnification Factor – Transmission Ratio – Self-Excited Vibrations – Support Motion – Unbalanced Rotating Forces
5	Sep 19-21, 2016	Damping – Vibration Measurement Instruments – Accelerometer Vibrometer – Seismometer - Design for Vibration Control
6	Sep 26-28, 2016	Multi Degree of Freedom System (MDOF) – Eigenvalues and Eigenvectors – Natural Frequencies and Mode Shapes
7	Oct 3-5, 2016	Static and Dynamics Coupling – Forced Vibration of MDOF Systems – Design Considerations for Vibration Isolation
8	Oct 10-12, 2016	Distributed Systems (Continuous) — Longitudinal & Transvers Vibrations of Rods - Wave Equation
9	Oct 17-19, 2016	Review for Midterm Test (Oct 17, 2016) **Midterm Exam (Wednesday; Oct 19, 2016)**
10	Oct 24-26, 2016	**Part-2 Control Systems:** Introduction to Control Systems – Open Loop and Closed Loop Systems – SISO & MIMO
11	Oct 31- Nov 2, 2016	Mathematical Modeling of Physical Systems – Transfer Function Block Diagram - Signal Flow Graph - System Stability
12	Nov 7-9, 2016	Routh-Hurwitz Stability Criterion – Transient Response System Types
13	Nov 14-16, 2016	Steady State Error – Controller Types – Proportional, Integral, and Derivative Control Laws
14	Nov 21-23*, 2016	State Variable Modeling – Solution of State Equations - Stability ***No Class on Wednesday Nov 23: Thanksgiving Holiday**
15	Nov 28-30, 2016	Time Domain and Frequency Domain Analysis – Nyquist Stability - Bode Plots
16	Dec 5-7, 2016	Root Locus Method - Controller Design Review of Course for Final Exam
Final	**Dec 14, 2016**	**Wednesday 7:45 PM – 10:00 PM (CL 234)**