San José State University
Department of Mechanical Engineering
ME 281 – Advanced Control System Design
(Digital Control Systems)
Spring 2015

Instructor: Dr. A. Rahimi
Lecture: T-Th 7:30 – 8:45 PM, Class Code: 26790
Classroom: Eng 232
Telephone: (408) 212-8374
Email: arz_rahimi@yahoo.com
Office Hours: T-Th 7:00 – 7:30 PM at Eng 348
Prerequisite: ME 280 or Equivalent course from other universities

Course Description
Digital control system design based on classical and modern approaches. Intelligent control system design. Establishment of design criteria. Discrete dynamic system behavior, sampling of the dynamic signal, stability, and synthesis of discrete control systems. Time domain analysis of discrete time dynamic system based on the transfer function and discrete time state dynamic equations. Computer aided dynamic system design and analysis. Case studies.

Required Text

Reference Book
Digital Control of Dynamic Systems, by Franklin, Powell, and Workman, Addison Wesley

Assignments and Grading Policy
Homework: 30%
Midterm: 30%
Final: 40%
Homework will be assigned weekly on each Thursday and is due on the next Thursday. Homework will be graded and retuned with the solution 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 physical behavior of discrete dynamic systems.
2. To learn how to select proper sampling time and its significance.
3. To learn basic dynamic system response behavior in time and frequency domain.
4. To learn how to test stability of system. Importance of pole/eigenvalues of system.
5. To learn how to design basic control systems based on the classic design methods.
6. To learn how to design control systems based on modern control design methods.
7. To learn basic technology related to implementation of digital control system.

Student Learning Objectives

1. The students will demonstrate an ability to analyze dynamic response of discrete linear systems using analytical method and computer-aided methods.
2. The students will demonstrate an ability to test stability of discrete dynamic systems.
3. The students will demonstrate an ability to examine the significance of poles and eigenvalues of discrete dynamic systems.
4. The students will demonstrate an ability to design basic controllers based on the classic control theory.
5. The students will demonstrate an ability to design modern motion control systems.
6. The students will demonstrate an ability to design & analyze digital control systems.

Course Outline

- Review of the Z-transform, Data Sampling, and signal reconstruction.
- Discrete-time Dynamic Systems and Time Response characteristics.
- Stability analysis and testing of Discrete-Time Systems.
- Sampled Data system design and analysis.
- Implementation of Digital Controllers.
- Linear Quadratic Optimal Control and system identification.
- Case Studies: Digital Servomotor Control, Digital Control of Disk Drives.

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/.

Spring Break: 3/24-26/2015 (No Classes)
Last Day of Instructions: 5/13/2015
Final Examination: 5/19/2015

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.
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<td>Chapter-1: Introduction – Overview of Digital Control Systems</td>
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<td>Jan 27-29, 2015</td>
<td>Chapter-2: Discrete-Time Systems and The Z-Transform</td>
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<td>Feb 3-5, 2015</td>
<td>Chapter-3: Data Sampling and Signal Re-construction</td>
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<td>Chapter-4: Discrete-Time Systems, Open-loop Characteristics</td>
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<td>Chapter-5: Discrete-Time Systems, Closed-loop Considerations</td>
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<td>Mar 3-5, 2015</td>
<td>Chapter-7: Stability Analysis Techniques of Discrete-Time Sys.</td>
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<td>Mar 10-12, 2015</td>
<td>Chapter-7: Stability Criterion: Nyquist and Bode Diagram</td>
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<td>MIDTERM EXAM (March 19, 2015)</td>
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<td>Chapter-8: Digital Controller Design; Criteria &amp; Specification</td>
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<td>Chapter-8: Classical Control Techniques for Controller Design</td>
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<td>Chapter-12: Case Studies for Digital Control Systems</td>
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<td>Final</td>
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