USC Viterbi School of Engineering

AME 544: Computer Control of Mechanical Systems
Spring 2017- Tuesday - 6.30-9.10 pm
Location: VHE210

Instructor: Serkan Kalender, Ph.D.
Office Hours: Thursday 6.30-8.30 pm and by appointment only
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Course Description:
Modeling of computer controlled machines including electrical and electronic components, actuators and sensors, discrete-time controller design, and implementation of control laws using computers/microprocessors.

Prerequisite(s):
AME 451 Linear Control Systems or equivalent

Required Textbook:
No textbook is required.

Recommended Textbooks:
Feedback Control of Dynamic Systems, Gene F. **Franklin**, J. Da Powell, Abbas Emami-Naeini
Digital Control of Dynamic Systems, Gene F. **Franklin**, J. David Powell, Michael L. Workman

Grading Breakdown

Assignment	% of Grade
Homeworks	20
Midterm Exam	40
Final (Experimental Report)	40
Total	**100**

Assignment Submission Policy:
Homework assignments that are turned in late will be accepted, but they will be marked down for each passing day.

Make-up Policy:
No make-up exams will be given without **prior** approval and then only for emergency purposes.

Disclaimer:
The instructor reserves the right to change, revise, and / or update the syllabus at any time during the semester if the need arises.

Course Schedule:

Week No	Date	Subject
1	01/10	Introduction and Overview
2	01/17	Actuators/Sensors/Amplifiers Motors (Brush and brushless DC servo Motors), Hydraulic Actuators, Optical (Incremental and Absolute) Encoders, Resolvers Linear and Switched (PWM) amplifiers
3	01/24	Modeling of Computer Controlled Machines
4	01/31	Feedback and Feedforward Compensation Techniques
5	02/07	Software Implementation of Servo-loop Closure
6	02/14	Discretization of Analog Controllers Backwards difference, forward difference and bilinear transformation methods, pole-zero mapping.
7	02/21	Direct discrete-time design of control laws, sampled-data analysis of motion control servo loops

8	02/28	Midterm Exam
9	03/07	Lumped parameter models of electro-mechanical systems with mechanical flexibility, collocated and non-collocated controller design, notch filter design
10	03/14	No Class- SPRING BREAK
11	03/21	Laboratory Experiment # 1: PD control of Rigid Body: System identification
12	03/28	PD design, experimental analysis of effect of sampling time on performance
13	04/04	Integral Control and feed-forward compensation
14	04/11	Laboratory Experiment # 2: 2 DOF plant System Identification
15	04/18	Non-collocated PD and non-collocated PD plus notch filter design and implementation
16	04/25	Non-collocated successive loop closure design and implementation
17	05/02	Last day to submit Experimental Report

Academic Conduct
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

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Support Systems
A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.