MEEG 311: Vibration and Control
Fall 2018

Lectures: Tues. and Thurs. 11:00AM - 12:15PM, Willard Hall, Rm 319.
Discussions: Wed. 5:45 - 6:35PM, Gore Hall, Rm 117 (TA: Indrajeet Yadav)
Fr. 5:45 - 6:35PM, Sharp Lab, Rm 109 (TA: Justice Calderon)

Instructor: Prof. Ioannis Poulakakis
Office: 205 Spencer Lab
Email: poulakas@udel.edu
Office Hours: Wed. 10:30 AM – 12:00 PM

TAs:

Indrajeet Yadav (Indra)
Office: Spencer Lab, Rm 131
Email: indragt@udel.edu
Office Hours: Wed. 3-5pm

Justice Calderon
Office: Spencer Lab, Rm 131
Email: juscal@udel.edu
Office Hours: Mon. 11:30-1:30pm

Textbook: The course textbook is:
K. Ogata , *Modern Control Engineering*, Prentice Hall, fifth edition, 2010
Note: Additional course material, announcements, and assignment grades will be available electronically through Canvas.

Description: The course requires students to apply principles of engineering, basic science, and mathematics (particularly differential equations), to analyze and design control systems. The main part of the course deals with single-input-single-output (SISO) dynamical systems expressed by linear differential equations with constant coefficients. The course (i) introduces basic concepts for modeling such systems, (ii) reviews first- and second-order systems and (iii) discusses ways to modify their dynamical behavior through the use of feedback control designs. We discuss the concepts of stability, steady-state and transient performance, and we introduce frequency-based analysis tools such as the root locus and Bode diagrams.

Grading:

Class participation	10%
Weekly Homework (collected **before** the lecture begins)	20%
In-class Mid-Term Exam (tentatively scheduled at the **end of Oct.**)	30%
Final Exam (day/time fixed by the University)	40%

Note: Late homework is accepted no later than one day after the deadline and at the expense of a 20% penalty. HW solutions will be given soon after the due date. You are encouraged to discuss HW problems with other students to gain a better understanding into the subject material.

Email Policy: I will make every effort to reply to your emails within 24 hours. As a result, if you email me less than 24 hours before a problem set is due, I may not be able to respond in time. If you have a complicated question, it is better to arrange to meet me. Also, the TAs will be happy to answer questions.

Website: Registered students can reach the course web page at canvas.

Schedule: ***The schedule is tentative—changes will probably occur as we progress.***

Week 1: 8/28, 8/30	Introduction, basic concepts - ODEs, states variables, solution of ODEs
Week 2: 9/4, 9/6	Laplace transform, transfer functions, impulse response, 2DOF mechanical systems, linearization, electrical systems
Week 3: 9/11, 9/13	Electromechanical systems – the DC motor, liquid-level systems
Week 4: 9/18, 9/20	Block Diagrams, open vs. closed loop, feedback control principles – transient and steady-state response, test input signals, first-order systems
Week 5: 9/25, 9/27	second-order systems, transient response specifications for 2nd-order systems, examples with P, PD control action
Week 6[1]: 10/2, 10/4	Stability and Routh's criterion – effects of P, I, D control action, steady-state errors and classification of control systems
Week 7: 10/9, 10/11	Root locus method
Week 8: 10/16, 10/18	Controller design examples using the root locus method (lead-lag compensation)
Week 9: 10/23, **10/25**	Review and **midterm exam**
Week 10: 10/30, 11/1	Frequency response, signals in the frequency domain, interpretations
Week 11: 11/6, 11/8	Bode diagrams and examples
Week 12: 11/13, 11/15	Nyquist plots and the Nyquist stability criterion
Week 13: 11/27, 11/29	Controller design in the frequency domain, phase and gain margins, lead-lag compensation, examples
Week 14: 12/4, 12/6	PID controller design in the frequency domain and examples, course review
Week 15: TBD	**Final Exam - Comprehensive**

[1] On 10/2 and 10/4 (Week 6) and on 10/9, the instructor will be travelling for conferences and workshops.