Fall
2024

SCUPI
Sichuan University - Pittsburgh Institute

MEMS 1045 Automatic Controls

(Modifications to this syllabus may be required during the semester. Any changes to the syllabus will be posted on the course website and announced in class)

Instructor: Qi (Michael) Lu, Ph.D.
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Lecture Time/Location: Wednesday 1:50 - 4:25 PM/Zone 4-201
Office Hours: Tue 2:00 - 5:00 PM, Thu 9:00-11:00 AM, Thu 2:00-5:00 PM

Teaching assistant (TA): Jiakai Xu (jiakai_x@163.com)

Note: for email, please

- Include the course number, your name and your student number in the subject field of your message;
- Use your university email account.

Credit hours: 3

Catalog Description:

Introduction to analysis and design of control systems, including applications to electromechanical systems. Students learn how characteristics such as stability, transient response, and steady-state error may be changed through dynamic compensation. Students become familiar with classical analysis and design tools in the context of single-input, single-output, linear time-invariant systems. (3 credit hours)

Course Objective:

At the completion of this course, students will be able to

- Understand the benefits of feedback
- Obtain and use transfer function to model dynamical systems
- Assemble complex systems using block diagrams
- Analyze stability of dynamical system
- Quantify system performance
- Design control systems for closed-loop stability and performance
- Understand PID control

Applicable ABET Learning Outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to function effectively on a team whose members together provide

leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Prerequisites:

ME 1014 Dynamic Systems or the permission from instructor.

Textbook:

Norman S. Nise, Control System Engineering, 8th edition, Wiley, 2019. ISBN – 978-1-119-59435-2

Tentative Course Schedule:

Date	Textbook	Topic
W.1 Sep. 4	1.1, 1.3-1.5; 2.1-2.2	Introduction Review of Laplace Transform
W.2 Sep. 11	2.3-2.8, 2.10	Differential Equations Dynamic Models
W.3 Sep. 18	3.1-3.7	Transfer Functions State Space Model
W.4 Sep. 25	5.1-5.5	Block Diagrams Block Reduction
W.5 Oct. 2	National Holiday	
W.6 Oct. 9	6.1-6.4	Stability of Linear Dynamic Models Routh-Hurwitz Criterion
W.7 Oct. 16	Midterm Exam I	
W.8 Oct. 23	4.1-4.6	Time Response First Order System Second Order System
W.9 Oct. 30	4.6-4.8, 7.1-7.2	Rise, Settling, Peak and Overshoot Steady-State Error Analysis
W.10 Nov. 6	7.3-7.5, 8.1-8.3	System Type Root Locus
W.11 Nov. 13	8.4-8.6	Root Locus Sketching
W.12 Nov. 20	Midterm Exam II	

W.13 Nov. 27	9.1-9.5	Design via Root Locus
W.14 Dec. 4	10.1-10.3	Frequency Response Analysis Bode Plot Nyquist Plot
W.15 Dec. 11	10.3-10.5	Nyquist Plot Nyquist Stability Criterion Gain Margin, Phase Margin
W.16 Dec. 18	11.1-11.5	Design via Frequency Response
W.17 Dec. 25	Final Exam	

Course Gradings:

- Attendance 10 %
- Studio & Homework 30 %
- Midterm exam I 20 %
- Midterm exam II 20 %
- Final exam 20 %

Grading Scale:

Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Percentage (%)	100~90	89~85	84~80	79~76	75~73	72~70	69~66	65~63	62~61	60	<60

Class Policies:

- **On-time attendance at all class activities is expected**. Student is responsible for any material that was covered, and any changes to the exam dates and homework assignments announced in class.
- **NOTE:** Students with **three unexcused absences** (including lateness or early departure) can be given a **zero** for their regular course grade. Students missing **a third of total class hours** in a semester (including all types of leaves) will lose the right to be assessed in that course, receiving a **zero** for the course grade.
- In general, no late assignment or make up exams will be accepted. If you have a serious conflict with an exam schedule, you must discuss it with the instructor and **take the exam early**. Failure to contact the instructor prior to the exam or assignment due date will result in **a zero** on that exam/assignment. Exams missed due to a serious illness or a family emergency (these must be documented) will be dealt with on a **case-by-**

case basis according to the University Policy.

- **Late submissions** for studio, lab reports or assignment are calculated based on the following equation

$$\textbf{Late submission full mark} = 100\% \times r^n$$

$r = 0.8$: discounted return coefficient; n : number of late weeks and n is an integer number which will be round up, e.g. $n = 1$ for the late submission within a week

- Any questions regarding the grading discrepancy should be brought up **within a week** after returning the homework, report or exam.
- Violations of academic integrity include, but are not limited to, cheating, plagiarism, or misrepresentation in oral or written form. Such violations will be dealt with severely, in accordance with University policy.