

Control Methods With Applications To Robotics

MIE 1064 F

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Course Topics:

1. Introduction to system dynamic modelling
2. Lyapunov stability
3. Controllability and observability
4. Feedback linearization
5. Pole assignment, optimal control
6. Outer loop control design
7. Robotic stability
8. Variable structure control
9. Adaptive control

Prerequisite: At least one introductory course in control is required and a Mechanical Engineering course in one of either Mechanisms or Vibrations.

Purpose of the Course: The main purpose of this course is to introduce a series of distinct topics in control to students who have not seen control system design beyond a first course in control, which includes classical methods such as root locus, and Bode design, for example. The topics discussed in MIE 1064 F are selected to give students a broad overview of a variety of control design methods and concepts in stability.

Grading Scheme:

Assignments:	20%
Term Project:	40%
Project Presentation:	<u>40%</u>
Total:	100%

1. Term project:

Written reports should be 25-30 pages in length, double spaced, 12 point font. The marking scheme for the written reports is as follows:

Abstract	10%
Introduction	20%
Literature review	40%
Discussion/Conclusion	20%
References	<u>10%</u>
Total:	100%

Project Abstract Submission: An abstract of your proposed project topic will be submitted in the first 4-5 weeks of the course. The control content of the project report must be 75%-80% control, i.e. the project mainly focuses on control. When the project abstract is approved, you may begin your project work. No grade is assigned for this abstract.

2. Oral presentations:

An oral presentation based on the Term Project will be presented to the class. The date and time for the presentation will be chosen by random draw.

The marking scheme for the oral presentations is as follows:

Clarity	20%
Technical content	30%
Ease of understanding	20%
Quality of overheads/PowerPoint slides.	10%
Ability to answer questions	10%
Overall performance	<u>10%</u>
Total:	100%

Presentations will be between 20 and 25 minutes in length given in the last two lecture periods. Duration will depend on class enrollment.

The purpose of the in-class project presentations is to expose students in the course to additional control related topics, beyond the lecture material. In this way, the breadth of knowledge obtained from the course may be increased. This implies that the presentation must be such that other students in the class learn from the presentations. Your presentation must be understandable to other students in the class. Hence the technical content and ease of understanding component of the above grades will be judged in light of this. The control content of the project presentation must be 75%-80% control, i.e. the presentation mainly focuses on control.

References:

1. Robot Dynamics and Control, Asada, H., Slotine, J., John Wiley, 1986.
2. Applied Nonlinear Control, Slotine, J., and Li, W., Prentice Hall, 1991.
3. Robot Dynamics and Control, Spong, M., Vidyasagar, M., John Wiley, 1989.
4. Linear Control Theory: The State Space Approach, F.W. Fairman, John Wiley and Sons, 1998.
5. Optimal Control, F. Lewis, John Wiley and Sons, 1986.
6. Algorithms for Computer Aided Design of Multivariable Control Systems, B. Bingulak, H.F. Van Landingham, Marcel Dekker, Inc., 1993.