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Dynamics of linear systems

Instructor

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Department: EE

Course Time: MWF 12:00-13:00

Lecture venue: EE B-308

Detailed Course Page: http://www.ee.iisc.ac.in/people/faculty/pavant/2017a-E1-241.html

Announcements

Brief description of the course

This is an introductory graduate level course in controls. Dynamics is a description of 'changeâ€™, typically as a function of time. Control is to effect a desired â€˜changeâ€™. In this course we will study the dynamics and control of linear systems.

Prerequisites

Linear algebra, differential equations, laplace transforms. Familiarity with some simulation software such as MATLAB.

Syllabus

- State space description, equilibrium points and linearization, qualitative behavior
- Solutions to LTI and LTV systems, Jordan form
- Lyapunov stability, input-output stability (time and frequency domain)
- Observability and controllability, minimal realization, modal controllability
- State feedback, stabilization, Lyapunov matrix equations, pole-placement
- Asymptotic observers, compensator design, and separation principle

- Preliminary quadratic regulator theory

Course outcomes

- Students would learn about state space description of systems.

- Students would learn fundamental concepts in linear systems and controls such as stability, controllability and observability.

- Students would learn formal mathematical (theorem-proof style) analysis in the context of controls.

- The students would be exposed to interesting applications in various domains.

Grading policy

- Homework: 20%
- 2 minor tests: 10%
- Mid-term exam: 30%
- Final exam: 40%

Assignments

A homework is assigned roughly every two weeks, each containing 4-5 main problems with many sub-problems. Homeworks contain a mix of formula based problems, problems that require systematic mathematical analysis/proofs and problems that explore interesting applications and open-ended problems.

Resources

There is no required textbook for this course. Some useful references are:

1. Joao P. Hespanha, â€œLinear systems theoryâ€•, Princeton University Press, 2009
2. Chi-Tsong Chen, â€œLinear System theory and designâ€•, Oxford University Press
3. Thomas Kailath, â€œLinear Systemsâ€•, Pearson, 2016 reprint of 1980 edition

4. Panos J. Antsaklis, and Anthony N. Michel. "A linear systems primer". Vol. 1. Boston: BirkhÃ¤user, 2007.