EECE 568: Control Systems
Syllabus

Dr. Meeko Oishi
http://courses.ece.ubc.ca/568

September 8, 2009

Instructor

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Office hours: Tuesday 2-4pm (tentative)

Course Location and Time

CEME 1212 Tuesday, Thursday, 12:30pm-2:00pm

Grading

30% Problem Sets
30% Midterm
40% Final Exam

Course Description

This course will cover fundamentals of linear dynamical systems and control at a graduate level for students in electrical or mechanical engineering. State-space analysis of continuous and discrete multivariable systems. Controllability and observability. Sensitivity considerations. Stability of linear and nonlinear systems.

Prerequisites

Students should be familiar with differential equations and linear algebra.

Course Updates

All course updates will be posted on the course website.

Course Readings/Text

Recommended texts:
A. Antsaklis and A. Michel, *A Linear Systems Primer*, Birkhauser 2007.
R. Stengel, *Optimal Control and Estimation*, Dover, 2002.

Course Policies

While collaboration and discussion is encouraged on all problem sets unless otherwise specified, each student must hand in their own individual work. Copying will not be tolerated. Students

must inform the instructor as soon as they are aware of conflicts with the course due dates.

Course Outline

1. **Introduction:** Examples, notation, first-order differential equations. State-space vs. input-output descriptions.
2. **Closed-form solutions:** State-transition matrix in continuous-time and discrete-time systems. Modes, asymptotic behavior. Qualitative response.
3. **Stability:** Equilibrium points, Lyapunov stability, Lyapunov equation. Linearization. Input-output stability.
4. **Controllability and observability:** Reachability, duality, Grammians.
5. **Uncontrollable / unobservable systems:** Stabilizability, detectability. Decomposition theorem.
6. **Internal / external descriptions:** Relationship between state-space and input-output descriptions. Lyapunov and input-output stability.
7. **Realization theory:** Minimal realizations, realization algorithms.
8. **State feedback and state observers:** LQR. Full-order and reduced-order observers. State estimation, LQG.
9. **Feedback:** Interconnected systems, parameterized controllers.

Course Due Dates

Problem Set #1	September 24
Problem Set #2	October 8
Midterm	October 22
Problem Set #3	November 12
Problem Set #4	November 26
Final Exam	TBD December 8-22