

## EEP 547 Linear Systems Theory

Tuesdays, 6:00pm - 9:50pm, Room ECE 037

Lecture (6:00pm - 8:15pm)

Lab (8:15pm - 9:50pm)

Instructor: Professor Linda Bushnell, [LB2@uw.edu](mailto:LB2@uw.edu)

office hours: Mondays 4:00 - 5:00 (Canvas Conference or in my office) or contact via email;  
starting Monday, September 30th

TA: Sang Sagong, [sagong@uw.edu](mailto:sagong@uw.edu)

TA office hours: Tuesdays 4:45pm-5:45pm, Room ECE 431 & Saturdays, 1:00pm-3:30pm, Room ECE 431

### **Textbooks & Software:**

- Joao Hespanha, "Linear Systems Theory," Princeton University Press, 2009 or any other Linear Systems Theory book (recommended)
- Matlab, Simulink, Control Systems Toolbox, Symbolic Math Toolbox (buy student version through UW, or use remote UW version)
- Minseg robot based on Arduino (UW will provide this to each student for the quarter)

### **Other Reference Books (many to choose from):**

1. P. J. Antsaklis and A. N. Michel, Linear Systems, McGraw Hill, 1997.
2. W. J. Rugh, Linear System Theory, Prentice Hall, 1993.
3. T. Kailath, Linear Systems, Prentice Hall, 1980.
4. C.T. Chen, Linear System Theory and Design, 3rd Ed, Oxford, 1999.

### **Grading:**

Homework 50%

Project 50% (MinSeg robot)

No midterm; no final exam

### **Prerequisite Skills:**

Linear Algebra

Laplace Transforms

Differential Equations

### **Schedule:**

See posted schedule under Files. We will have 10 classes. There is no midterm or final exam. The last class will be project presentation night.

## Topics Covered:

- System Representation: modeling, transfer function, state space, linearization, causality, time invariance, linearization
- System Response: LTV and LTI systems, impulse response, step response, frequency response, Bode Plots
- Stability: Lyapunov, Input-Output
- Controllability: concept of controllability, controllable subspaces, decompositions
- Observability: concept of observability, output feedback, minimal realizations
- State-variable Feedback from state space model
- State Observers from state space model
- PID control via transfer function model
- LQR controllers from state space model
- Use of Matlab and Simulink to explore concepts covered above.
- Implementation of above concepts on a MinSeg robot