EEP 547 Linear Systems Theory

Class Time: 6:30 – 9:50pm Thursdays

Classroom: TBD

Instructor: Professor Linda Bushnell, LB2@uw.edu

Office hours: 5:00 – 6:00pm Thursdays, in office ECE M342

TA: TBD; Office hours: TBD

Introduction:

Each week, we will have a lecture followed by a hands-on laboratory in the same classroom. The lecture will cover topics in linear systems theory. The laboratory will work with these concepts in Matlab and Simulink and on a MinSeg robot. All students will get a MinSeg robot kit to take home and work with.

Textbooks & Software:

- (Recommended) Joao Hespanha, "Linear Systems Theory," 2nd Ed., Princeton University Press, 2018 or any other Linear Systems Theory book
- 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% (drop lowest score)

Project 50% (MinSeg robot)

No midterm; no final exam

Schedule:

We will have 10 classes. There is no midterm or final exam. The last week will be project presentation.

Prerequisites:

- Linear Algebra

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