EEP 547 Linear Systems Theory

Class Time: 4:00 – 5:50pm Tuesdays and Thursdays

Note: each class will have a lecture followed by a hands-on laboratory, so attendance in person is required both days. The lecture will cover topics in linear systems theory, as stated below. The laboratory will work with these concepts on a MinSeg robot. All students will get a MinSeg robot kit to take home and work with.

Instructor: Professor Linda Bushnell, LB2@uw.edu

office hours: 3:00 – 4:00pm Tuesdays and Thursdays, in office EEB M342

TA: TBD

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

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.

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