ELEG 5413 Advanced Control Systems

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Textbook (Required):


Prerequisite: ELEG 5403 or instructor permission

This is the second course in a two-course sequence in control systems. ELEG4413 extends the theory developed for linear systems covered in ELEG4403 (transfer functions, Bode plots, lead-lag and PID) to include multiple-input multiple output systems, hybrid systems (discrete-time and digital systems interfaced to continuous-time analog systems) and commonly encountered nonlinear effects. This course has applications to many areas of design engineering. We will employ Matlab-Simulink throughout the course for both analysis and design. Applications will focus on robotics, power electronics, motor drives, power systems and biomedical & physiological dynamics. The design project is intended to demonstrate the design and analysis concepts with application to practical engineering objectives.

Topics:

1. Analysis
   a. (Week 1) State-space mathematical modeling of dynamic systems
   b. (Week 2) Linear Algebra and State-Space Differential Equations
   c. (Week 3) Observability and Controllability

2. Design
   a. (Week 4) Pole Placement
   b. (Week 5) State Estimation and Observers
   c. (Week 6) Quadratic Optimal Control
   d. (Week 7) Introduction to Random Processes in Control Design
   e. (Week 8) Variable Structure Systems (Sliding Mode Control)

Grading:

• Homework (eight assignments): 40%
• Test I Analysis Techniques: 15%
• Test II Design Methods: 15%
• Final Design Project (Matlab-Simulink): 30%

Approximate Grade Assignment:  
> 85% - A
> 70% - B
> 55% - C
< 55% - D or F