MECA 482: Control System Design

Catalog description: 4.0 units

Modeling and simulation of dynamic system performance. Control system design for continuous systems using both analog and digital control techniques.

Prerequisites: MATH 260, EECE 211
Recommended: MECA 380, MECH 320; either EECE 135 or MECH 306

Course objectives: For students to

1. Learn to specify performance criteria for control systems
2. Design controllers to meet specifications
3. Use Matlab® and Simulink® to aid in the design of control systems

Course outcomes: Students shall be able to

1. Apply Laplace transforms to solve differential equations
2. Model mechanical, electro-mechanical, and electrical components
3. Convert models from time domain to complex domain
4. Convert models from time domain to state space form
5. Convert from state space representation to transfer function representation
6. Apply Mason's rule to create a single-input-single-output representation of a system
7. Apply Laplace transformation technique to perform time response analysis of a system
8. Repeat time response analysis using Matlab®
9. Repeat time response analysis using Simulink®
10. Perform stability analysis of a system using Routh-Hurwitz criterion
11. Perform Root Locus analysis of a system using Matlab® to study the influence of poles and zeros on the performance of the system
12. Perform frequency response analysis of a system using Matlab® to study the influence of poles and zeros on the performance of the system
13. Collect performance data in the laboratory and express it as a transfer function

Topics covered

1. Introduction to control concept
2. Laplace transformations
3. Modeling of dynamic behavior
4. Block diagrams and Mason's rule
5. Response analysis
6. Root locus analysis
7. Controller design
8. State-space method

Class/Laboratory schedule

Two hundred minutes of lecture per week

Contribution of course to meet the professional component

This course contributes to the student's ability to work professionally in the mechanical systems area.

Relationship of course to Mechanical Engineering Program Outcomes

This course contributes principally to Program Outcomes A, C, and D.