



BAKER COLLEGE
STUDENT LEARNING OUTCOMES

EE 3610 Dynamic Systems and Control
3 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Illustrate the conceptual design and build of control systems in modern engineering applications
 - a. Introduce the basic history of control theory and practice
 - b. Outline the elements of control system design in context of engineering design
 - c. Distinguish between open-loop and closed loop control systems

2. Produce mathematical models of engineering systems to enable their control
 - a. Construct mathematical models of physical systems using differential equations and linear approximations
 - b. Apply Laplace transforms to obtain transfer functions
 - c. Implement transfer functions and impulse response functions in modeling control systems.
 - d. Use block diagram models to represent a control system.

3. Adapt basic state-space theory to control systems
 - a. Employ block diagrams and signal flow graphs to create state variable models
 - b. Apply mathematical models to solve problems involving the control of the following systems
 - i. Mechanical Systems
 - ii. Electrical Systems
 - iii. Fluid Systems

4. Examine feedback control system characteristics
 - a. Demonstrate the role error signals in analysis of control systems
 - b. Relate the improvements afforded by feedback control in reducing system sensitivity to parameter changes.
 - c. Apply transient-response analysis with and without computational software to solve problems involving the control of first order dynamic systems.

5. Illustrate the performance of feedback control systems
 - a. Use test signals to observe resulting transient response characteristics of second-order systems
 - b. Show relationship between pole locations of second order pole locations and transient response as defined by percent overshoot, settling time, rise time and time to peak.
 - c. Apply transient response analysis to with and without computational software to solve problems involving the control of second order dynamic systems.

6. Assessing stability of linear feedback systems
 - a. Compare concepts of absolute and relative stability
 - b. Show the relationship of the s-plane pole locations (for transfer function models) and of the eigenvalue locations (for state variable models) to system stability
 - c. Construct a Routh array and employ the Routh-Hurwitz stability criterion to determine and optimize stability.

7. Adapt the Root Locus Method
 - a. Demonstrate the concept of the root locus and its role in control system design
 - b. Design a controller to meet desired specifications using the root locus methods
 - c. Compare characteristics of PI, PD and PID controllers and discuss choice of controller vs application.

Project Student Learning Outcomes and Enabling Objectives

8. Complete a course project involving topics of the course integrating both transient and steady state response analysis of the system.
 - a. Formulate mathematically the description of an engineering system with its controller and quantitatively describe system variables and desired performance specifications.
 - b. Evaluate close loop control system response to variable inputs using Matlab and Simulink software.
 - c. Validate controller design performance and system stability through computational software.
 - d. Construct and deliver comprehensive technical presentation

These SLOs are not approved for experiential credit.

Effective: Fall 2017