AE 3515 SYSTEM DYNAMICS AND CONTROL 4-0-4

Catalog Description:
Dynamic modeling and response of systems with mechanical, hydraulic, electrical, and/or thermal elements. Classical methods of feedback control system design and analysis. Prerequisites: AE2220 and (MATH 2403 or MATH 2413 or MATH24X3)

Purpose of Course:
The purpose of this course is to provide students with a foundational understanding of dynamics and control of physical systems, particularly mechanical, hydraulic and electrical systems, and to prepare them for the follow-on courses: AE3521 Aircraft and Spacecraft Flight Dynamics, and AE 4525 Feedback Control Systems Lab.

Course Outline:

Topics	Hours
1. Introduction	1
2. Background Material for System Analysis and Design	8
Complex numbers, variables and functions	
Laplace transformation	
Inverse Laplace Transformation	
Solution of linear, time invariant differential equations	
Linearization	
3. Mechanical Systems	6
Mechanical elements	
Modeling of mechanical systems	
Work, Energy, and Power	
4. Linear System Analysis in the Time Domain	6
Transfer functions	
Transient response of first and second order systems	
Impulse response	
Transient response analysis using MATLAB	
5. Linear System Analysis in the Frequency Domain	8
Frequency response of first and second order systems	
Bode diagrams	
Vibration isolation	
Vibration absorbers	
6. Modeling of Dynamic Systems in State Space	8
State-space representation	
Eigenvalues and eigenvectors	
Solution of state equations	
7. Reduction of Block Diagrams	2
Simple Structures	
Block Diagram Reduction	
Mason's Rule	
8. Performance of Feedback Systems	5
Transient Performance	
Steady State Error Calculation	
9. Root Locus Technique	6
Rules	
PD and PID Controllers	
Lead and lag Compensation	
Example root locus designs	
10. Frequency Response Methods	6
Bode and Nyquist Plots	
Nyquist Stability Criterion	
Gain and Phase Margins	
Example Frequency Domain Designs	
11. Exams	4
Total	**60**