AE 4525: CONTROL SYSTEM DESIGN LABORATORY (1-3-2)

Catalog Description: AE 4525: Control System Design Laboratory. Experiments in system dynamics and control with emphasis on vehicle flight control system design.

Text: AE4525 Laboratory Manual.

Course Coordinator: Prof. Eric Johnson

Learning Objectives: This laboratory course is designed to give students in Aerospace Engineering a clear understanding and working knowledge of flight control system design and analysis. This includes an intuitive understanding of the affect of feedback, the experience of applying control theory to actual hardware, and exposure to how feedback flight control systems are developed.

Expected Outcomes: Students will be able to develop feedback control systems. They will be able to develop an appropriate model, select appropriate feedback signals, synthesis feedback gains, and analyze their results. They will understand the effects of proportional, derivative and integral feedback on closed loop system response behavior in the context of controlling real hardware.

Prerequisites: AE3515 (System Dynamics and Control) and (concurrent) AE3521 (Flight Dynamics)

Lecture and Laboratory Topics:
Week 1:
Lecture: Familiarization and review of computational tools such as MATLAB, SIMULINK, etc.
Lab: Example problems in the use of MATLAB and SIMULINK
Week 2:
Lecture: Modeling of a Single Degree-Of-Freedom System
Lab: DC motor
Week 3:
Lecture: Control of a Single Degree-Of-Freedom System
Lab: DC servo motor
Week 4:
Lecture: Modeling of a Two Degrees-Of-Freedom System
Lab: Torsional pendulum experiment
Week 5:
Lecture: Control of a Two Degrees-Of-Freedom System
Lab: Torsional pendulum experiment
Week 6:
Lecture: Control of a Three Degrees-Of-Freedom System
Lab: Helicopter experiment
Week 7:
Lecture: Control of a Nonlinear System
Lab: Inverted pendulum experiment
Week 8:
Lecture: Gyroscopic principle
Lab: Gyro Stabilized Platform experiment
Week 9:
Lecture: Review of A/C static stability
Lab: Horizontal and Vertical Tail Sizing (MATLAB based)

Week 10:
Lecture: Longitudinal SAS design
Lab: Longitudinal SAS Design and Evaluation (MATLAB and SIMULINK based)
Week 11:
Lecture: Longitudinal SCAS Design
Lab: Longitudinal SCAS Design and Evaluation (MATLAB and SIMULINK based)
Week 12:
Lecture: Lateral SAS design
Lab: Lateral SAS Design and Evaluation (MATLAB and SIMULINK based)
Week 13:
Lecture: Lateral SCAS design
Lab: Lateral SCAS Design and Evaluation (MATLAB and SIMULINK based)
Week 14:
Lecture: Summary
Lab: Make-up of any missed experiments
Week 15:
Final exam