AE 6534 Control of Aerospace Structures

Catalog Description: Control of Aerospace Structures. 3-0-3. Prerequisite: AE 6531.
Advanced treatment of control of flexible structures. Topics include stability of multi-degree of freedom systems, passive and active absorbers and isolation, positive real models, and robust control for flexible structures.

Topics

Motivation
- flexible aircraft and spacecraft
- disturbance sources
- performance specifications

Review of SDOF Vibrations and Linear System Theory
- compliance, admittance, impedance, inertance
- state space models, realizations, free and forced response, resonance
- harmonic steady state analysis

Control of Lumped Parameter Systems
- Lagrangian dynamics for modeling multiple degree-of freedom systems
- time and frequency domain analysis of MDOF second-order models
- Lyapunov stability theory and stability of MDOF systems
- passive absorbers and isolation
- active control
- controllability/observability/stabilizability/detectability
- stability via Routh-Hurwitz, root locus, Bode, Nyquist
- standard control problem
- collocated control
- interlacing zero properties
- positive real models
- positive real lemma
- dissipative controller synthesis
- noncollocated control
- nonminimum phase zeros
- H_2, H , Maximum Entropy, Popov controller synthesis
- robust control

Distributed Parameter Systems
- modeling strings, beams, trusses, membranes, plates, and shells of various shapes and with various boundary conditions
- modal density
- discretization of DPS
- Rayleigh-Ritz, Galerkin, finite elements
- modal truncation and model reduction
- active control of DPS
- damping mechanisms and models
- sensor and actuator types and models
- wave models
- wave number, wave vector, phase and group velocity, dispersion
- defraction, reflection, refraction, scattering
- Statistical Energy Analysis

Course Objective: To provide students with an advanced treatment of control of flexible aircraft and spacecraft.

Prerequisites: AE 6531

Computers: Several assignments will require computations using MATLAB, Control System Toolbox, and the μ-Toolbox.

Recommended Textbooks:

1. S. M. Joshi, *Control of Large Flexible Space Structures*, Springer, 1989.
2. J.L. Junkins, ed., *Mechanics and Control of Large Flexible Structures,* AIAA, 1990.
3. L. Meirovitch, *Dynamics and Control of Structures*, Wiley, 1990.