

AE 6580: Aerospace Nonlinear Control

Catalog Description: AE 6580 – Nonlinear Control (3-0-3). Prerequisite: AE 6532 or equivalent. Advanced treatment of nonlinear robust control. Lyapunov stability theory, absolute stability, dissipativity, feedback linearization, Hamilton-Jacobi-Bellman theory, nonlinear H_∞ , backstepping control, and control Lyapunov functions.

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Course Objective:

To provide students with an advanced treatment of nonlinear robust control as applied to aerospace systems.

Topics:

An Introduction to Nonlinear Systems

- Nonlinear Differential Equations
- Lyapunov Linearization Methods
- Lyapunov Stability Theory

Absolute Stability Theory

- The Lur'e Problem
- Kalman-Yakubovich-Popov Equations
- Dissipativity, passivity, nonexpansivity
- Nonlinear H_∞ Equivalents
- Dissipative Controller Synthesis

Feedback Linearization

- Normal Forms
- Input-State Linearization
- Input-Output Linearization

Nonlinear-Nonquadratic Optimal Control

- Hamilton-Jacobi-Bellman Equations
- Control Lyapunov Functions

Nonlinear Disturbance Rejection Control

- Hamilton-Jacobi-Isaacs Equations
- Storage Functions and Supply Rates
- Nonlinear Differential Games

Robust Nonlinear Control

- Nonlinear Parametric Uncertainty Characterizations
- Robust Control Lyapunov Functions
- Robust Hamilton-Jacobi-Bellman Theory

Backstepping Control

- Linear and Nonlinear Block Backstepping
- Optimal Backstepping Control
- Disturbance Rejection Backstepping Control
- Robust Backstepping Control