New Course:

AMES 207 (Spring 98)

NONLINEAR CONTROL

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Topics: Circle and Popov criteria, small gain theorem, passivity. Describing functions. Nonlinear controllability, feedback linearization, input-state and input-output linearization, zero dynamics. Stabilization, Brockett's necessary conditions for local stabilizability, control Lyapunov functions, Sontag's formula for global stabilization. Methods for design of control Lyapunov functions and stabilization: integrator backstepping, forwarding. Inverse optimality and stability margins. Disturbance attenuation for nonlinear systems, deterministic and stochastic, nonlinear H-infinity control. Adaptive nonlinear control, tuning functions method, extremum seeking. Nonlinear observers. Examples from robotics, satellite and underwater vehicles, compressors and combustion, biotechnology.

Texts:

- H. Khalil, *Nonlinear Systems,* 2nd ed, Prentice Hall, 1995, ISBN 0471127329
- M. Krstic, I. Kanellakopoulos, and P. Kokotovic, *Nonlinear and Adaptive Control Design,* Wiley, 1995, ISBN 0471127329
- Handouts to be distributed in class from: Isidori, *Nonlinear Control Systems,* Sontag, *Mathematical Control Theory,* Sepulchre-Jankovic-Kokotovic, *Constructive Nonlinear Control,* and Krstic-Deng, *Stabilization of Nonlinear Uncertain Systems.*

Prerequisite: AMES 207 Nonlinear Systems (Winter 98) or equivalent.

Time and Place: TTH 5:30-6:50, HSS 2305A

Office Hours: M 5-6 or by appointment (e-mail, phone)

Grading: 35% homework, 30% midterm, 35% final