Course number

ECE666

Course name

Control Systems II

Prerequisite

ECE660

Course description

1. Introduction
   Classifications of nonlinear control problems
   Observer-based design: extended separation principle.
   Examples.
2. Trajectories of Second Order Systems
   Linear Systems: Nodes, foci, saddle points, centers.
   Nonlinear: Limit cycles
   Higher order systems; chaotic behavior
3. Lyapunov's Theory of Stability
   Definitions of stability and asymptotic stability.
   Local stability: Lyapunov's First Method
   Large-scale (global) stability: Lyapunov's Second Method
   Basic theorems of Lyapunov's Second Method
   Some applications in control systems
4. Full-state feedback algorithms for unbounded control
   Linearization about reference state.
   Extended linearization: state-dependent Riccati equation (SDRE) method.
   Feedback linearization
   Other methods
5. Full-state feedback algorithms for bounded control.
   Introduction: sets of reachable points for unstable plants.
   Optimal control (time optimal and related)
   Linear and nonlinear switching control
   Pulse width and pulse frequency control.
6. Observers
   Extended Kalman Filter
   Extended linearization filter
   Discrete-time observers.
   Observers with all kinds of data.
Parameter estimation and related observers

- Course learning outcomes
  - Student will be proficient in designing feedback control algorithms for nonlinear dynamic processes.
  - Student will be proficient in use of Matlab’s Control System Toolbox and Symbolic Toolbox
  - Student will be proficient in use of Matlab /Simulink to simulate closed-loop control systems

- Textbook and/or other resources
  - Matlab

- Course calendar
  - Lectures: Weekly, September 12 – December 7
  - Final Exam: December 14
  - Project due: December 14

- Grading Schema
  - Final Exam: 40%
  - Homework: 40%
  - Project: 20%

- Academic Integrity policy
  - University policy will be observed.