State-Space Control Systems

ECE 5551

Credit Hours:
3.00 - 3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Discrete-time state variable representations; pole placement via state-feedback; introduction to realization theory; observer design; introduction to Kalman filtering; linear quadratic regulator theory.

Prerequisites and Co-requisites:
Prereq: 3050 and Stat 3470; or Grad standing.

Course Goals / Objectives:
- Learn feedback control systems design by pole placement (state feedback) and state observers
- Introduce students to Kalman filtering and Linear Quadratic Regulator (optimal control)
- Develop tools for analysis and design of discrete-time control systems, from a state-variable viewpoint
- Exposure to computer-aided analysis and design (using Matlab) and simulation
Course Topics:
- State variable models
- Continuous state variable models, sample and hold, system delays in state variable representations
- State variable representation in discrete time, solution of state variable difference equations
- Design using discrete equivalents, numerical integration methods
- State space models, stability, and control design (controllability and pole placement)
- Estimator design and observability
- Separation principle, inclusion of reference input and integral control
- Introduce students to advanced topics of realization theory, Kalman filtering, and Linear Quadratic Regulator (optimal control)

Designation:
Elective