Powertrain Control Systems

ECE 5554

Credit Hours:
3.00 - 3.00

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

Course Components:
Lecture

Course Description:
Application of digital control system theory, from viewpoints of input-output and state variable representations, to realistic problems in automotive powertrain systems.

Prerequisites and Co-requisites:
Prereq: 3551 or 5551, or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.

Course Goals / Objectives:
- Gain a basic understanding of automotive electronics, sensors, and typical control modes for internal combustion engines and automatic transmission systems
- Learn principles of control-oriented modeling of realistic automotive powertrain systems
- Develop tools for analysis and design of discrete-time control systems, using Z transforms
- Develop tools for analysis and design of discrete-time control systems, using state-variable techniques
- Become proficient in computer-aided analysis and design using Matlab and Simulink
Course Topics:
- Powertrain systems, automotive electronics, sensors and actuators
- Control-oriented modeling of powertrain systems (input-output and state variables)
- Overview and review of digital control principles as applied to powertrain systems, including Z-transform for design, and state variable techniques
- The idle speed control problem, analysis, modeling, and control system design (multivariable control)
- The air-to-fuel ratio control problem, analysis, modeling, and control system design
- Estimator design and observability for idle speed control and air-to-fuel ratio control
- Introduce students to Linear Quadratic Regulator (optimal control) as applied to multivariable powertrain control systems
- Transmission systems control modes

Designation:
Elective