THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Energy Modeling, Optimization, and Control of Hybrid Vehicles

MECHENG 7384

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture
Independent Study

Course Description:
Fundamentals of advanced propulsion vehicles (HEV, PHEV, BEV, FCV), covering motivation, architectures, taxonomy and components, energy analysis, modeling, simulation, optimization, and supervisory control/energy management principles.

Prerequisites and Co-requisites:
Prereq: Grad standing, or permission of instructor.

Course Goals / Objectives:

- Analyze and quantitatively evaluate energy consumption in road vehicles. Relate energy usage in road vehicles to fuel economy and exhaust emissions
- Understand the concept and potential benefits of drivetrain hybridization strategies; develop and use mathematical models of energy storage and energy conversion subsystems used in advanced propulsion vehicles
- Develop methods for modeling energy storage and power flow processes in advanced propulsion vehicles, and implement the methodology using Matlab/Simulink
- To formulate and solve (numerically) optimization problems in advanced propulsion vehicles
- Learn principles of optimal energy management and supervisory control strategy for optimal energy storage in advanced propulsion vehicles
- To apply control methodologies to problems concerning driveability and energy usage in advanced propulsion vehicle
- Synthesis of advanced propulsion vehicle analysis and simulation through an advanced propulsion vehicle design and optimization of fuel economy using simulation environment in Matlab/Simulink

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Course Topics:

- Energy consumption of vehicles, driving cycles
- Motivation for advanced propulsion vehicles (HEV, PHEV, BEV, FCV)
- Review of energy conversion systems (engines, fuel cells, electric machines)
- Review of energy storage systems (chemical fuels, batteries, supercapacitors, flywheels)
- Review of transmission systems (manual, automatic, CVT, EVT)
- Energy modeling of advanced propulsion vehicle systems
- Design optimization of hybrid electric vehicles
- Energy management and optimization of advanced propulsion vehicles
- Advanced propulsion vehicle supervisory control

Designation:

Elective