ENME454: Vehicle Dynamics Fall 2015

Chesapeake Project Sustainability Description

Vincent Nguyen, Dept. Mechanical Engineering

This course covers vehicle handling dynamics and general automotive vehicle design. A large part of the curriculum relates to powertrain development (engine and transmission technology).

Sustainability Learning Objective: To discuss and understand the role of how technology can be utilized to reduce the resource consumption and emissions of automobiles.

Specific Sustainability Objectives/Topics:

- Engine mapping and fuel consumption:
  - What factors affect engine performance?
  - Where are the "sweet spots" for operation?
- Driving cycle needs:
  - What are the predominant factors determining power needs?
  - How do these vary for different situations and drive cycles?
  - What types of power sources or drivetrain schemes are necessary to achieve these requirements?
- Utilizing advanced engine and transmission control for fuel economy:
  - How can transmission and engine controls (throttle-by-wire, computer controlled transmissions, CVTs …) be utilized to optimize fuel economy across a driving cycle?
- Qualitative discussion of alternative fuels:
  - What are the attractive features of alternative fuels? (ex. availability, renewability, emissions …)?
  - What main hurdles are associated with alternative fuels? (ex. vehicle technologies, infrastructure change, social economic changes …)
  - What is the role of subsidizing in meeting the challenges?
  - What total lifecycle costs must be considered? (ex. upstream and downstream emissions)
- Hybrid vehicle control schemes
  - How can multiple power generators be utilized to increase general engine performance and fuel economy?
  - What total lifecycle costs must be considered? (ex. total upstream/downstream emissions, manufacturing costs and penalties, disposal/recyclability …)
  - How do short term incentives aid in the development of technologies that may be beneficial in the future? (ex. battery/motor technology, the role of subsidies …)

Integration and Assessment:

These topics will be integrated into the lectures and qualitative assessment will be integrated into the exams (which make up a large component of the grading). Specific quantitative calculations (fuel consumption and/or BSFC calculations) will be integrated into current assignments (acceleration simulations, dynamometer data analysis), and one small research/discussion assignment will be given on alternative fuels.