Determine Duty Cycle for Autonomous Vehicle with a Hybrid Drive Unit

Abstract:

Autonomous vehicles will be an imperative part of the transportation mobility industry. In order to assure the design of the hybrid drive unit in an Autonomous vehicle meets all durability and reliability requirements, a duty cycle is needed. The duty cycle will consist of voltages, temperatures, torques, and speeds the drive unit experiences over time to assure that all electrical, mechanical and fluid systems within the hybrid drive unit in an Autonomous vehicle are designed properly. A duty cycle and the amount of cycles needed does not exist for Autonomous vehicles.

The student team for this project will research how Autonomous vehicles are and will be driven, what environments they will be driven in, and how these driving conditions differ from conventional vehicles. Additionally the student team will lean the hybrid drive unit limitations. Finally the student team will propose a duty cycle for Autonomous Vehicles with Hybrid Drive Units that meet our durability and reliability numbers.

Scope:

Minimum Viable Product

- Research past and present industry standards, from the Society of Automotive Engineers (SAE) and other sources, on Autonomous Vehicles with Hybrid Drive Units duty cycle (usage) and reliability
- Work with GM Internal groups on vehicle data collection in process, related to Autonomous Vehicles with drive unit feedback
- Learn hybrid drive unit limitations and requirements; voltages, temperatures, torques, speed, distance/time.
- Learn hybrid drive unit electrical, mechanical and fluid systems. Understand how each system will be influenced by the limitations and requirements
- Determine Duty cycle for Autonomous Vehicles with a Hybrid Drive Unit
- Define Break-in cycle required on Dynamometer for Hybrid Drive Units that correlate to Vehicle level testing.

Expected Deliverable

- Create a Matlab script of the proposed duty cycle

Stretch Goals

- Design of Experiment with simulated results on reliability

Student Skills:

What specific skills will be needed by students to be successful on this project? These are from last year

Project Roles	Key Skills and/or Knowledge	Likely Majors
Electrical Engineering (2)	Motors, Rotors, Hybrids, Matlab	Electrical Engineering: EE
Data Analysis and Predictive Analytics (2)	Data analysis techniques, experience modeling experimental data	Data Science, MIDAS, Statistics
Mechanical Modeling, Simulation and Testing (2)	Systems, Gears, Transmissions, Drive Units, Mat Lab	Mechanical Engineering, Chemical Engineering, Physics

Location:

Most design work will take place on North campus. There will be periodic visits to GM locations. Testing will take place at GM locations in Pontiac. (MDP will provide transportation)

Sponsor Mentor:

Wyciechowski, Heather – Lead Project Mentor – Test Technical Specialist

Hysko, Alfonso – Senior Project Mentor – Test Technical Specialist

Harding, Thomas — Engineering Group Manager for Test Technical Specialist and Transmission Validation Department– General Motors

Faculty Mentor

Are there any specific members of the faculty whom you would like us to approach for your project? All projects receive a faculty mentor for each student team.

Legal Requirements:

Citizenship Requirements

- This project is open to all students regardless of citizenship status

Intellectual Property Agreements / Non-Disclosure Agreement Requirements (please select)

- Students will sign an IP/NDA document that is unique to my organization (must be approved by UM Legal Team)

Company Information:

At General Motors, we are passionate about earning customers for life. This vision unites us as a team each and every day and is the hallmark of our customer-driven culture.

In fact, there are a lot of exciting things to share about our company. Our story starts on November 18, 2010, when we completed the world's largest initial public offering, emerging with a solid financial foundation that enables us to produce great vehicles for our customers and build a bright future for employees, partners and shareholders.

Leading the way is our seasoned leadership team who set high standards for our company so that we can give you the best cars and trucks. This means that we are committed to delivering vehicles with compelling designs, flawless quality and reliability, and leading safety, fuel economy and infotainment

features. All are intended to create that special bond that can only happen between a driver and their vehicle.

Making the world's best vehicles can only happen with the world's greatest employees. We take great pride in our work, and take great care to deliver exceptional cars and a positive ownership experience to our customers around the world.