MONASH
ENGINEERING

MONASH
University

Faculty of Engineering
Summer Research Program 2022-2023

Project Title: Analysis of system level powertrain parameters and efficient energy deployment for an Electric Vehicle (EV) application

Supervisor(s): Dr. Behrooz Bahrani, David Klink

Department: Electrical and Computer Systems Engineering

Email: behrooz.bahrani@monash.edu , David.klink@monash.edu

Website profile of project supervisor: https://www.monash.edu/pearl

---

Objective

The variability of load and speed in electric vehicle duty cycles means that powertrain optimization is a complex multi-objective problem. EVs have significant feedback effects due to their onboard stored energy and this impacts the optimum powertrain configuration. Matching the characteristics of the powertrain system to the application and dealing with trade-offs in its constituent parts can significantly improve the performance. Additionally, energy deployment strategies can improve utilization of designs.

This is a complex, multi-objective optimization considering the inherent properties of an electric powertrain constituents (battery, inverter, motor and gearbox) and their combination and application to achieve optimal system level performance with additional external application specific constraints.

Project Details

In motorsport, "lift and coast" is a widely used strategy that is employed when energy deployment is limited, either due to energy storage, thermals or external limitations.
In EVs and hybrids, the problem is also complicated by additional considerations such as all wheel drive vehicle controllers, and the balance of mechanical and regenerative braking which reduces energy wastage but increases load on the powertrain.

This project will explore relationships between various Electric Powertrain components and analyse various deployment strategies, to understand and optimise system level design and energy deployment. The methods developed will be applied to a case study where the application is electric motor sport (Formula Student or FSAE), however the problem is generally applicable to EVs and solutions can be applied to other key EV industries such as automotive, aerospace and trucking / logistics automation.

Prerequisites
- Experience with electric vehicle / mobile energy storage systems, ideally through Monash student teams looking at electric vehicles such as Monash Motorsport or UAS.

Additional Information