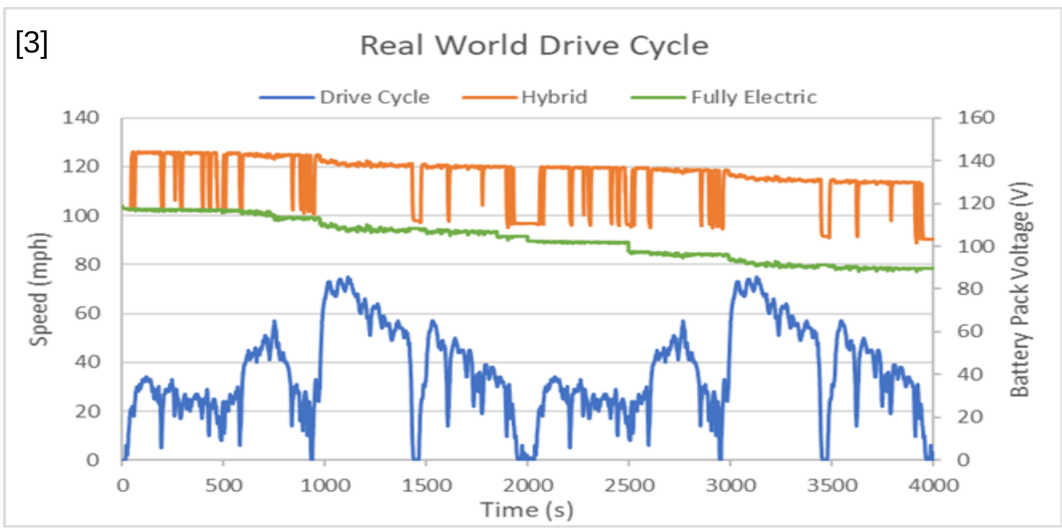
Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

An Investigation into the Feasibility of Motorcycle Hybridization

Jason Sorg

School *of* **Engineering**

BEng (Hons) Motorcycle Engineering



Introduction

The current uncertainty of where the motorcycle industry is headed in terms of future designs that meet new emissions laws while still supplying the consumer with a familiar product is the driving force behind this project. The current solution to this problem are fully electric motorcycles, and although these machines have proven to have grabbed a foothold in the industry, many consumers are not making the switch due to range / performance limitations when compared to internal combustion engines. Which is why the idea of hybridization is currently being discussed and is the reason behind this project.

[1]

Project Aims

The end goal of this project was to develop a Simulink model capable of accurately modelling a fully electric motorcycle, and then integrating a hybrid system into the Simulink model [2], which would be able to accurately predict the benefits / limitations of the hybridized powertrain. The results generated from this research will help determine the feasibility of hybridization

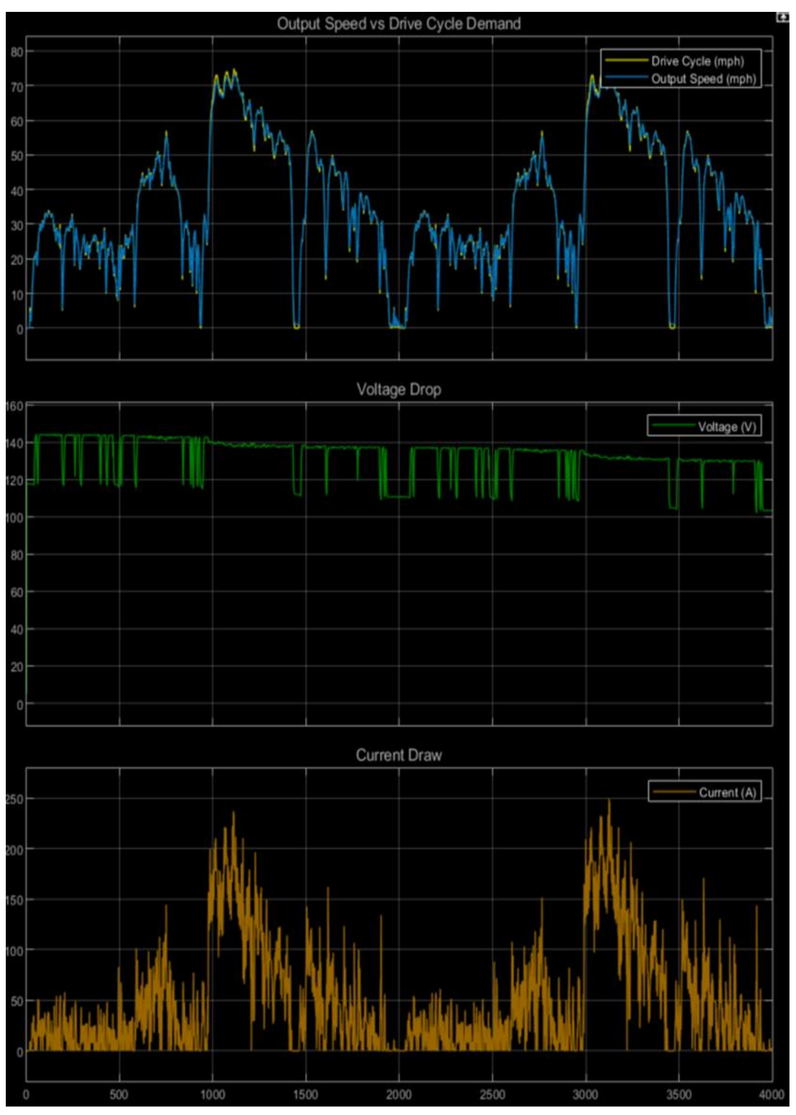
Methodology

The first step was to create a validated fully electric simulator for steady state and dynamic drive cycles. This was achieved by correlating real-world third party data for a Zero SR/F motorcycle and then using the error percentage to determine the predicative capability of the simulator. The next step was to integrate a hybrid powertrain to the model by developing a DC-DC generator that could utilize different hybridization strategies. The following list was the final hybridization specifications used for the research:

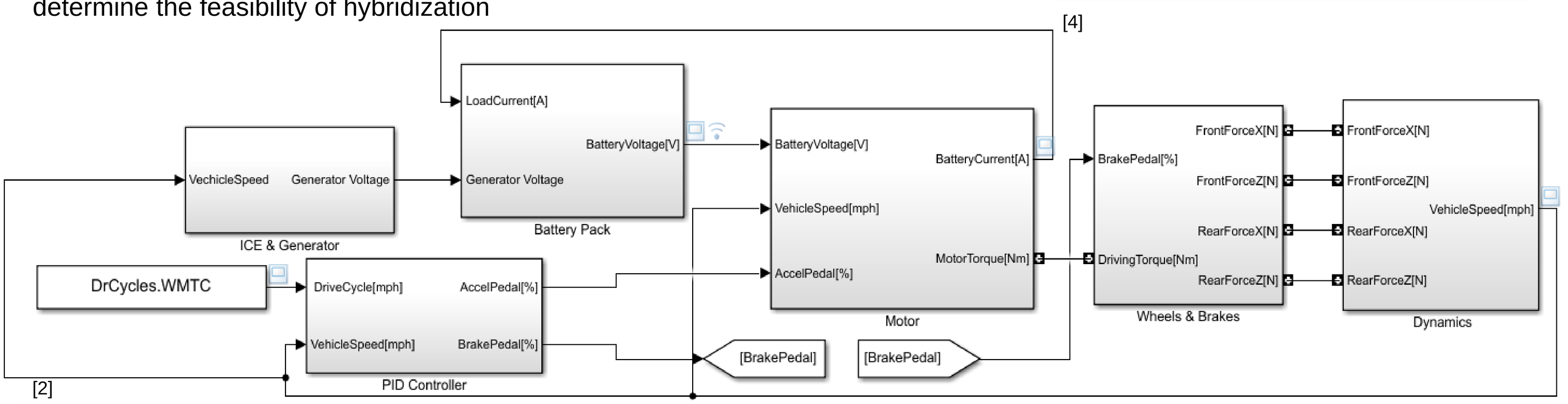
- Motorcycle Geometry – Zero SR/F.
- Electric Motor – Z-Force Motor 75-10 adapted from a 2019 Zero SR/F.
- Battery Pack – Farasis 32Ah cells in a configuration of 28 Series and 2 parallel.
- DC Generator / DC-DC Converter – Lifan LF170f-BDQ generator
- Hybridization Strategy – ICE operational at 20 mph with a 5 second delay.

Results

The model was stress tested against steady state data, regulated drive cycles and real-world drive cycles. The common theme among all testing was the addition of a hybridized system provided an average voltage drop reduction of **22.15%.** Meaning that for a real-world drive cycle the extended range was around **19.83** miles, [3] [4].



[4]



[2]

References

[1] Motorcycles, Z. (2019, June 26). 2020 Zero SR/F, Retrieved from Robb Report: https://robbreport.com/motors/motorcycles/2020-zero-sr-f-electric-motorcycle-2856053/

[2] Powertrain Blockset, (Jason, Authors Own)

[3] , [4] Real World Drive Cycle Results, (Jason, Authors Own)

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