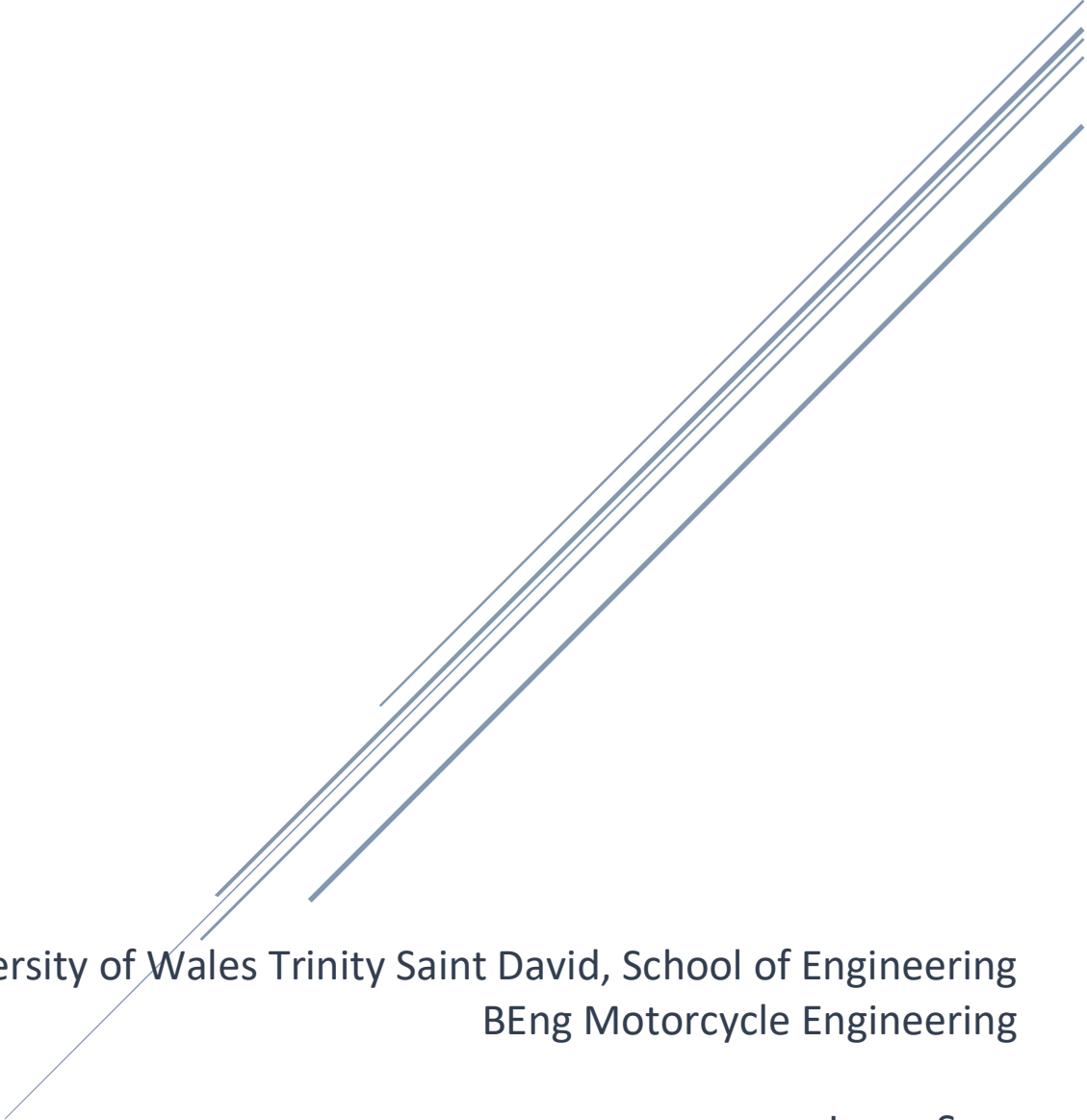


MOTORCYCLE HYBRIDIZATION PROPOSAL

Major Project, (M6X00417)



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Project Relevance

The automotive industry has been through a big change in the last decade with the current trend leaning towards electrifying passenger cars in order to solve the emission / responsible usage problem. Presently, the automotive industry has been very successful in creating vehicles that mimic the previous generation of gasoline / diesel vehicles by creating a product that produces comparable power output along with similar range. Typically, the motorcycle industry is about a decade behind when it comes to the emission laws, as Euro 4 was implemented for passenger cars in 2005 and in 2016 for Motorcycles. Meaning that motorcycle manufactures did not have to put as much emphases on emissions when designing new products, but with Euro 5 being implemented in 2020 for motorcycles (Anon., 2019), the industry will have to start to evolve their designs.

One of the biggest problems motorcycle manufactures will face when trying to completely electrify the modern motorcycle is the amount of packaging space that is required. Currently there are a few motorcycle companies doing a completely electrified motorcycle with quite a bit of success, except the biggest limitation is that they are having to pick if the end product will be geared towards performance or economy. This is why I believe that the current solution to making motorcycles comply with higher Euro emission ratings while keeping the end product as similar to the previous generation is to hybridize the modern motorcycle. This solution will potentially solve the current problem of packaging by using a small fuel efficient two or four stroke engine as a battery charger for the main source of power. This will potentially allow motorcycles to retain similar power output levels with farther range when compared to completely electrified motorcycles. This of course is only a viable solution until the current battery technology catches up with the new advancements of electrification in the modern world.

Aims of The Project

The purpose of this project is to determine the viability of hybridizing the modern motorcycle by researching / designing a system that utilizing a fuel efficient two or four stroke engine which will charge a smaller battery pack when compared to a fully electric powertrain. This will allow for better performance / range, which is why this project is aimed at whether or not the solution is viable. If it is determined that the solution is possible the next step would be to determine which combination of hybridization is more suited for standard motorcycle operation and then designing the possible packaging solution along with what equipment would be needed for a successful combination. Another key area that will be looked at very closely is how the current drive cycle for motorcycles is derived and then in turn calculate the potential increase from hybridizing.

Provisional Work Plan

The current plan is to continue with researching the potential benefits of hybridizing a motorcycle and then determining the appropriate powertrain that would yield the best results. These results will then be compared with current motorcycle emissions / drive characteristics to determine the suitability of hybridizing the motorcycle. After these stages are complete the next task will be to design a hybrid powertrain that would fit into a standard motorcycle frame. Finally, the results will be validated against automotive hybrid vehicles along with fully electric motorcycles.

Background Research

In order to determine the likelihood of designing a successful hybrid motorcycle most of the initial research has gone into investigating how the automotive industry successful created hybrid vehicles. The most successful hybrid vehicles in the market are the Toyota Prius and Chevrolet Volt, both vehicles offer consumers a solution to lower their individual carbon footprint as well as creating a product that has a range of approximately double when compared to similar fully electric vehicles. Particularly the Chevrolet Volt is of most interest due its powertrain using a gasoline powered engine to charge a smaller battery

pack. This technology is more suited towards motorcycles because of the small packing space needed when compared to using a system like the Toyota Prius where both electric and gasoline power sources are used to drive the vehicle directly.

Currently Kawasaki has successfully manufactured a type of Hybrid motorcycle which uses an electric motor to assist during low speeds and launches. This system combines the instant torque applied by the electric motor at low RPM's to support acceleration until the small four stroke engine is operating at speed within its power curve (Motorcycling, 2019). Essentially this system works perfectly in a low horsepower commuter motorcycle but does not scale up to larger displacement motorcycles because again the packaging size needed would be too great due to the need to have a larger displacement gasoline engine along with larger electric motor and transmission to smoothly apply power between the two power sources.

Required Software / Facilities

The following list will be the projected software and University resources needed:

- MATLAB
- SolidWorks
- MS Office Suite
- Technical support from UWTSD Staff
- 2D Data analysis