

IPRO 342 (Fall 2006)

Hybrid Electric School Bus

Introduction:

The objective of this IPRO is to develop a small-scale platform which simulates the working components of a hybrid electric vehicle (HEV). Through the design and construction of this platform, the typical components of a HEV are implemented on a low-power scale, simulating a similar real-world system (i.e. a HEV school bus). The platform thereby provides a means of testing and optimizing a HEV system on a small scale, with the ultimate ability to take the optimized system and realize it on a real-world scale.

Platform:

The testing platform (also referred to as a “test bed”) will take the form of a model HEV drive train, containing all essential components. This includes an electric motor to simulate an internal combustion engine, an electric machine to provide two way electrical-mechanical power transfer (for supplemental power delivery and regeneration), and the associated mechanical interfacing components between the two (planetary gearing, etc.). At the present, preliminary designs have been completed (components sized and selected, requisite parameters established).

Dynamometer:

As a first phase in the development of the test bed, a simple dynamometer was constructed to operate an electric motor under simple loading conditions. The dynamometer contains the intended drive motor for the “test bed” and its associated power electronic controller. This system interfaces with a computer through dSpace (an interface package). The dynamometer also employs a load motor which serves to apply running loads to the drive motor and a torque sensor. Through testing of the dynamometer, some of the mechanical and electrical difficulties inherent to the construction of the final “test bed” are revealed (i.e. electronic control problems, mechanical vibration, etc).

Model Car:

As a means of demonstrating the hybrid concept on a very small scale, a typical model car using an internal combustion engine was modified to incorporate an electric motor. The model thereby employs a combined engine/motor system to improve performance by increasing total vehicle power and improving instantaneous acceleration.

Lego Bus:

Also as a means of demonstrating the hybrid concept on a very small scale, it consists of two electric motors with one acting as the ICE and the other as the EM and generator, with both coupled together by a planetary gear. Also shows the concept of regenerative braking.

Future Work:

While the preliminary design for the test bed is complete, it remains to be realized. The succeeding team should take the proposed design and the results obtained from the construction and testing of the dynamometer and combine them to develop a final design for the test bed.

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