

FIELDHOUSE RESEARCH FELLOWSHIP MIDTERM REPORT

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Hybrid Vehicle Power System Design

The project objective is to develop an automated design scheme for the power system of a hybrid vehicle. Figure 1 illustrates the design approach from the perspective of parameter inputs and design decision outputs. The project scope consists of four tasks: Task 1: Formulate the globally optimal design scheme. Task 2: Collect data on device parameters and the drive cycle characteristic. Task 3: Apply collected data to the formulated design scheme. Task 4: Validate the generated system and controller design on a high fidelity vehicle model.

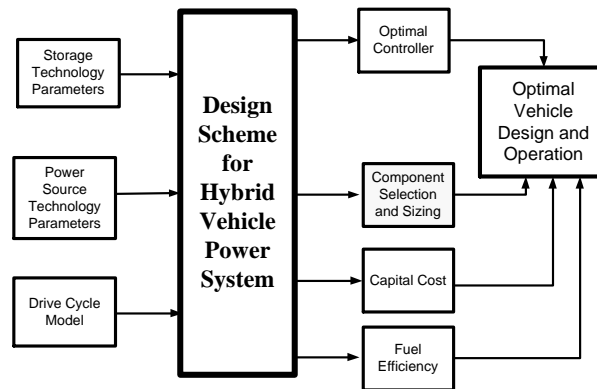


Figure 1: Hybrid Vehicle Power System Design Scheme.

To date the project activities have focused on tasks 1 and 2. With regard to task 1, extension of the design formulation to include the fuel economy performance metric and component selection capabilities is underway and is currently being tested. With regard to task 2, the capabilities of PSAT (the power-train simulation software developed by Argonne National Laboratories) are being explored.

Publications:

1. S.K. Ahmed and D.J. Chmielewski, "Power System and Control Design for Hybrid Fuel Cell Vehicles," Proc. of the Am. Cont. Conf., (2010), pp 6612-6617.
2. S.K. Ahmed and D.J. Chmielewski, "Membrane Hydration Regulation in a PEMFC," *Chem. Eng. Sci.*, submitted 2010.
3. S.K. Ahmed, J-K. Peng and D.J. Chmielewski, "Covariance Based Hardware Selection, Part 3: Distributed Parameter Systems," *AIChE J.*, submitted 2010.

Presentations:

1. S.K. Ahmed and D.J. Chmielewski, "Power System and Control Design for Hybrid Fuel Cell Vehicles," Am. Cont. Conf., Baltimore, MD, June 2010.
2. S.K. Ahmed and D.J. Chmielewski, "Power System and Control Design for Hybrid Fuel Cell Vehicles," AIChE Chicago Poster Competition, Northwestern U., April 2010.
3. S.K. Ahmed and D.J. Chmielewski, "Energy Storage Technology Selection for Hybrid Fuel Cell Vehicles: A Globally Optimal Control System Based Approach," submitted to the 2010 AIChE Annual Meeting, Salt Lake City UT.
4. S.K. Ahmed and D.J. Chmielewski, "Massive Energy Storage Design for Renewable Electricity Generation Systems," submitted to the 2010 AIChE Annual Meeting, Salt Lake City UT.
5. S.K. Ahmed and D.J. Chmielewski, "Multi-scale Modeling and Control of a PEM Fuel Cell," submitted to the 2010 AIChE Annual Meeting, Salt Lake City UT.