MASTER THESES IN THERMODYNAMIC & PROCESS SYSTEMS

Contents

Fuel Cell Vehicle Concept Model

A fuel cell vehicle (FCV) is an electric vehicle that uses a hydrogen fuel cell in combination with a battery as a source of power for its electric motor/s. Fuel cell in a vehicle generate electricity generally using oxygen from the air and compressed hydrogen. Most fuel cell vehicles are classified as zero-emissions vehicles that emit only water and heat. As compared with internal combustion vehicles, hydrogen vehicles centralize pollutants at the site of the hydrogen production, where hydrogen is typically derived from reformed natural gas.

Modelon offers a wide library spectrum covering automotive powertrain, electric, thermal components, and fuel cells.

The aim of this thesis is to create low and high-fidelity FCV model in Modelon Impact (state of art web based Modelica platform). The actual design should start at the concept stage, sizing the vehicle components to meet specified criteria followed by more detailed thermal study allowing the vehicle to operate in different driving conditions.

Contact: jiri.navratil@modelon.com, Modelon AB

Thermal Management Design for Electrical & Hybrid Vehicles

There is a strong agreement that the market for electrified vehicles is increasing, but there are lots of consumers that are not yet convinced. Their main concerns relate to limited driving range, battery charging times & life, and overall safety. The electrical parts will become essential part of vehicle powertrains. They need to be integrated into the powertrain not only mechanically, but it is necessary to come up with an appropriate thermal management ensuring their correct functionality at different conditions.

Modelon offers a wide library spectrum covering automotive powertrain, electric and thermal components.

The aim of this thesis is to create low and high electrified vehicle models in in Modelon Impact (state of art web based Modelica platform) which can be used for component sizing, thermal management design and control. These models should be used for investment return analysis based on given driving conditions.

Contact: jiri.navratil@modelon.com, Modelon AB

Model development and energy system integration of hydrogen production units

Many experts consider hydrogen a cornerstone of the future energy system. For example, the German government recently announced an Investment of nine billion euros for promoting hydrogen technologies. Low temperature proton exchange membrane (PEM) electrolyzers are widely used for flexible and efficient production of hydrogen from electric energy and water. Integration of this technology into energy systems often involves dynamic models for system design and development of operation strategies. The focus of this master thesis project is the development a model for the PEM electrolyzer including the chemical, thermodynamic and electrical effects. Furthermore, the work includes modeling the integration of the component into different energy system examples available from Modelons libraries, e.g. a MicroGrid example to investigate efficient hydrogen production strategies from renewable energy sources such as wind and photovoltaics.

Modelica is an object-oriented modelling language developed for multi-physical system simulation that should be used as a basis. The project will include the following tasks:

- Literature review of existing technology
- Development of a proton exchange membrane electrolyzer model in Modelica
- Validation of the model based on measurement data
- Simulation of application examples for energy supply systems

As a student you will have the chance to work with Modelons software solutions and benefit from industry experience and guidance of our experienced team of experts. The model and system integration examples shall be built on Modelons libraries, utilizing a large variety of basic components for energy and hydrogen systems.

Contact: moritz.hubel@modelon.com, Modelon Deutschland GmbH

Theme of Choice

Modelon is constantly looking for motivated and skilled master thesis students with strong focus on modeling and simulation of physical systems as well as good knowledge in mathematics and thermodynamics. A suitable theme can always be discussed and agreed upon.

Contact: moritz.hubel@modelon.com, Modelon Deutschland GmbH

Modelon has well established academic cooperation with several departments at Lund Institute of Technology, LTH. Further, Modelon works together with other universities in and outside of Sweden.