Chalmers – SIEMENS Coordinated Master thesis work

CHALMERS UNIVERSITY OF TECHNOLOGY

SIEMENS Ingenuity for life

THERMAL MANAGEMENT OF A BATTERY ELECTRIC VEHICLE

This project is collaboration between Chalmers University of Technology, Division of Vehicle Engineering and Autonomous Systems (VEAS) and Siemens Digital Industries Software. The research at VEAS is concerned with Multiphysics vehicle-level modeling and simulations with special focus on thermal management of electrified drivetrains. Siemens offers with the Simcenter portfolio a set of industry-leading software products for predictive engineering analysis, of which Simcenter Amesim is the software tool focusing on system-level simulations. The students have the possibility to work with Amesim in a professional manner that is highly recognized in automotive industry and beyond.

Project relevance and background

Thermal management is one of the key design challenges of a battery-electric vehicle (BEV). It considers multiple objectives like e.g. keeping powertrain components within specified temperature limits to retain health and optimal performance in different driving scenarios, ensuring thermal comfort for passengers, as well as optimal energy flows to maximize the vehicle's range. The higher efficiency of the electrical driveline implies also that there is considerably less waste heat available that can be harvested in the thermal management system (e.g. for cabin climatization). Thermal management is a vital point of interest for both industry and consumers to ensure new vehicles meet those expectations.

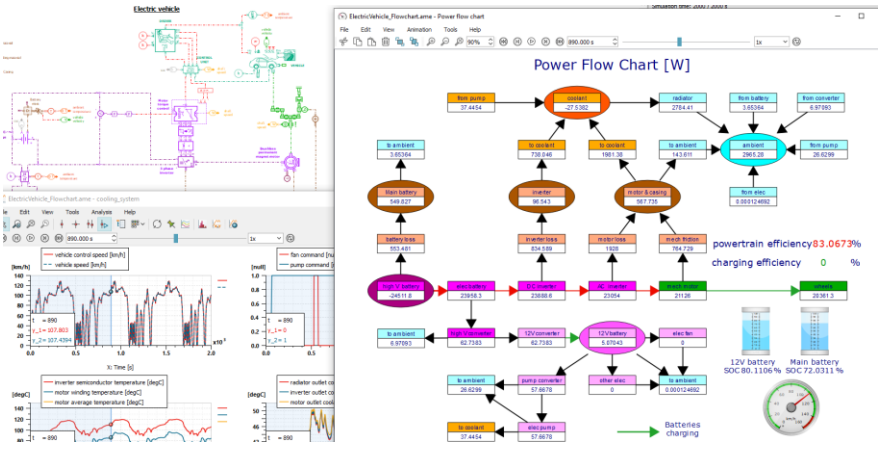

Figure 1: Example model for battery-electric vehicle (BEV) and post-processing of power flow between driveline components.

Chalmers – SIEMENS Coordinated Master thesis work

Project scope, requirements and deliverables

The scope of this project is to perform modeling and simulations to study energy flows in BEVs starting from the existing vehicle model in Simcenter Amesim™ software, one of the industry leading tools for vehicle simulations, on an existing electric vehicle model. The studies will focus on investigating the effects of different driving cycles and ambient conditions on the heat release from the vehicle components and comprise:

- Calibrating and validating the thermal model of the motor-gearbox assembly using representative measurement data.
- Performing the sensitivity studies (temperatures, heat flow) based on the level of thermal model discretization.
- Evaluating the thermal vehicle model performance for different transient drive cycles (e.g. WLTC).
- Investigating how different non-standard ambient conditions (e.g. cold weather) affect the heat release from driveline components and verifying the thermal management strategy.

Terms and qualifications

Number of students: 2	**Starting date:**
Educational background: Mechanical, Electrical, Automotive Engineering, Control Systems	Advantageous skills: Previous knowledge of system-level simulation tools, Matlab Simulink

Contact persons

Jelena Andric, PhD, Docent, Division of VEAS, M2, Chalmers, jelena.andric@chalmers.se

Gunnar Latz, PhD, Application support, Siemens Digital Industries Software, gunnar.latz@siemens.com