Development of a System Simulation Tool for the Pre-Design of Battery Electric Vehicles

Context

IFP Energies nouvelles (IFPEN) is a major player in research and training in the fields of energy, transport, and the environment. From research to industry, technological innovation is at the heart of all its activities. As part of the public-interest mission entrusted to it by public authorities, IFPEN is committed to providing solutions to address society's energy and climate challenges by promoting the emergence of a sustainable energy mix.

IFPEN is involved in the development of solutions for battery electric vehicles (BEVs). These solutions specifically include:

- The development of eco-designed electric machines based on innovative topologies
- The implementation of advanced control strategies for electrical systems
- The creation of simulation tools for BEV powertrain components (battery, converters, motors) as well as for the overall vehicle

To facilitate technological choices during the pre-design phases of BEVs, numerous simulations at different scales are required to compare various powertrain configurations and diverse driving conditions. This apprenticeship is set in this context, aiming to contribute to the development of a system simulation tool for BEVs, integrating a simplified consideration of the impact of ambient temperature on range.

Main tasks

The goal of this apprenticeship is to participate in the development of a pre-design tool for BEVs. More specifically, you will have to implement the optimisation of the powertrain to maximise the vehicle's range in real driving conditions. Moreover, constraints will gradually be added to the optimisation process (such as charging procedure and environmental impact limitation through life cycle analysis).

The work will proceed in several stages:

1. Getting familiar with the existing tool and Simcenter Amesim
2. Conducting a literature review on the optimisation of electric powertrains (strategies, constraints, etc.)
3. Implementing the optimisation within the simulation tool
4. Validating the tool by comparing it with experimental data
5. Adding recharging and lifecycle assessment (LCA) constraints to the optimisation

Note: some aspects related to the consideration of thermal effects in range calculation may also be addressed.

Profile: Final-year student in a general engineering school / Master's degree (M2) / specialised Master's program. Interest in the fields of energy, transport, and thermal systems. Knowledge of Simcenter Amesim and C programming is desirable. Proficiency in English (spoken and written). Curiosity, teamwork skills, and the ability to work independently are essential. IFP School profile is a plus.

Location: IFP Energies nouvelles, Rueil-Malmaison (France)

Languages: Fluent in English or French

If you are interested, send your CV and cover letter to tristan.lombard@ifpen.fr