CIFRE PhD Offer

Subject title	Optimization of architecture and advanced control strategies for thermal management of electric vehicles	
Supervisors	Guillaume COLIN Alain CHARLET Timothée SCHMODERER	Stéphane MAUREL Kiwan NOSSIN
Location	Laboratoire PRISME 8 rue Léonard de Vinci 45072 Orléans Cedex 2 FRANCE	Stellantis 212 Boulevard Pelletier, 78955 Carrières-sous-Poissy FRANCE

Description of the subject

The automotive industry is rapidly shifting towards electric vehicles (EVs) in response to environmental concerns and strict emission regulations. Technological advancements in batteries, electric motors, aerodynamic and thermal management systems are crucial. These systems keep critical components at optimal temperatures, thereby improving the efficiency and longevity of EVs.

The proposed thesis project aims to develop an optimal architecture and control strategies for the thermal management of electric vehicles (EVs). This project addresses several key challenges: Energy Efficiency, System Integration, Component Durability, Occupant Comfort, Regulatory Compliance, Safety. Innovations include advanced modeling and simulation methods and multi-objective optimization techniques for more efficient and adaptive thermal management systems.

The first step involves determining the best configuration of thermal components, such as heat exchangers, heat pumps and valves, to maximize energy efficiency and minimize costs. This includes thermal modeling of the components and the overall system, as well as evaluating the performance of different topologies under global energy consumption, cost and occupant comfort constraints. Next, the thesis focuses on developing optimal control strategies using advanced methods such as dynamic programming (DP). These methods will allow for optimal heat distribution management, requiring precise modeling of components and the overall system to evaluate the performance of different topologies. This step includes evaluating the performance of thermal systems under various driving scenarios and climatic conditions to ensure their robustness and adaptability.

The expected results of this thesis include the demonstration of the feasibility of online control of thermal systems for the cabin and the electric vehicle powertrain. This control must meet constraints (comfort, aging, etc.), achieve the objectives of reducing the overall consumption of the vehicle, and quickly adapt to driving and climatic conditions.

A deposit on the ANRT web site will be carried out as well as a request for access to the laboratory (ZRR).

Skills in demand

Strong skills in applied mathematics (automatic control theory, optimization, machine learning) and/or in thermal/energy modeling of systems
Knowledge of associated tools would be appreciated (e.g. Matlab/Simulink, python, GTSuite, Amesim)
Automotive knowledge would be appreciated.
Very good written and oral communication skills (in French) and English.

Application

Send CV, cover letter and transcript **before 10th January** 2025 to phd_stellantis_prisme2025@univ-orleans.fr