



Thermal management of phase change cooling systems for electric and hybrid vehicles

Research center : IMT Lille Douai - Centre d'Enseignement, Recherche et Innovation Énergie Environnement (CERI EE)

Position : fixed term, 36 months

Location : IMT Lille Douai – Site de Douai – CERI EE

Context

Created by the merger of Mines Douai and Telecom Lille on January 1st, 2017, IMT Lille Douai is the largest graduate school of engineering in the north of Paris. It aims at teaching the general engineers and digital experts of the future. Located at the crossroads of Europe, between Paris, London, Brussels and Amsterdam, IMT Lille Douai intends to become a major player in industrial and digital transformation of the society by combining engineering science and digital technologies.

Based on two sites dedicated to research and education in Douai and Lille, IMT Lille Douai has research facilities of almost 20,000m² devoted to high-level scientific activities in the following areas:

- Digital science,
- Energy and Environment,
- Materials and Process engineering applied to polymers, composites and civil engineering

Description and aim of the PhD research project

Environmental issues are now widely addressed in the automotive world. Priority is given to the development of electric vehicles and hybrid vehicles which requires highly efficient thermal management systems that precisely control temperature to ensure optimum performance and longevity of the batteries. The proposed PhD research program is within this framework aiming to design optimized battery coolers for electric and hybrid vehicles. The general objective of the thesis is to analyse physical phenomena involved and develop new strategies. The work will be carried out within the framework of the industrial research chair NEO (Numerical and Experimental Optimization platform for efficient design of automotive heat exchangers) which results from a long-term fruitful collaboration between a major worldwide industrial company and the Energy Environment Center for Education, Research and Innovation (CERI EE) of IMT Lille Douai. The CERI EE of IMT Lille Douai, which has been working on those topics for twenty five years, has very good expertise both in terms of experimental and numerical tools to be used to carry out research in this field, as well as in related physical phenomena.

Optimizing the performance of battery thermal management systems requires to control the heat exchange conditions in cooling systems with internal two-phase flow. To optimally design these milli heat exchangers, the development of accurate modeling approach will be undertaken based on CFD software (StarCCM+) for various geometrical and operating conditions. This numerical modeling approach will be assessed by means of experimental data, that also will enable the analysis of the fundamental phenomena of heat transfer with phase change in complex geometries. Experiments will be carried out on test benches specifically developed with a postdoctoral researcher working with the doctoral student during the first year of the PhD. Under various operating conditions several configurations will be analysed from both global point of view, as well as on local point of view to complete analysis. Finally the work will then consist in improving the design of the cooling systems, using the modeling tool developed, by optimizing the heat transfer and the system architecture. Writing of several scientific publications is expected during the PhD.

Applicant profile

Applicants must hold a Master of Science and/or be a graduated Engineer in the energy engineering scientific field : thermal science, fluid mechanics. The main skills required to carry out the proposed research program are as follows :

- Multiphase flow numerical modeling
- Computational Fluid Dynamics
- Experimental analysis and test bench design for global performance measurement
- Analysis of flow characteristics (visualization, velocimetry)

The candidate must be rigorous, with high quality edition skills and proficient in the English language. Knowledges on one or more of the following softwares ou languagues : CFD code (StarCCM+, Ansys FLUENT), Java, C++, Matlab would be highly appreciated

Information

For more information about the PhD proposal, please refer to :

- Pr. Daniel BOUGEARD, PhD supervisor, daniel.bougeard@imt-lille-douai.fr
- Dr. Serge RUSSEIL, serge.russeil@imt-lille-douai.fr

Application

Starting date expected : 1st October 2020

Applicants are invited to send their Curriculum Vitae, a cover letter, a transcript of their Master's grades and two reference letters to Serge Russeil (serge.russeil@imt-lille-douai.fr) with reference to the PhD proposal.