RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: Energy, Processes
Subfield: Thermodynamics, fluid mechanics, heat transfer

Title: Heat transfer intensification for next generation thermal energy systems

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Short description of possible research topics for a PhD:
In all energy systems such as those used for electricity production, air conditioning or hydrogen compression heat transfer plays a crucial role on the efficiency of the system. This is especially important when operating in real gas conditions and in trans-critical conditions such as in heat pumps, super critical CO2 cycle and Organics Rankine cycle. Low or moderate heat transfer coefficient require higher temperature difference which destroy exergy and larger transfer area which increase the cost of the system.
In this study, we will investigate experimentally the possibilities of heat transfer intensification in trans-critical and supercritical conditions by mean of fluctuating flow rate, vibrating walls and surface treatments. For sub-critical and trans-critical conditions, the two phase flow and phase transition will also be investigated for the heat transfer enhancement. The results can be integrated in new models for CFD computations and systems modelling and will be used to carry out exergy analysis of an integrated system.

Required background of the student: Energy, energy systems, thermodynamics

A list of 5 (max.) representative publications of the group
1. M. Deligant, E. Sauret, Q. Danel, and F. Bakir. Performance assessment of a standard radial turbine as turbo expander for an adapted solar concentration ORC. Renewable Energy, 2020
2. M. Specklin, M. Deligant, S. Porcheron, M. Wagner, F. Bakir Experimental study and modelling of a high-pressure ratio liquid piston compressor. HEFAT 2019, Wicklow, Ireland
3. M. Deligant,X. Nogueira, S. Khelladi, E. Sauret, B. Reding. Toward a high resolution real gas finite volume solver with multi Optimal Order Detection. 5th International Seminar on ORC Power Systems, Athens, Greece, 2019
4. M. Deligant, M. Specklin, and S. Khelladi. A naturally anti-diffusive compressible two phases kapila model with boundedness preservation coupled to a high order finite volume solver. Computers and Fluids, 114, 2015