Title : Turbocharger turbine modeling at off-design operating conditions.

Keywords : turbocharger, turbine, axial, mixed, radial, performance, efficiency, CFD, experiments

Turbocharging allows using engines in better operating conditions and reducing polluting emissions including carbon dioxide. The use of a turbocharger requires knowledge of the functioning of each of its elements, in particular the turbine, in the manufacturer's map area but also outside this area, at off-design conditions, in particular to calculate the efficiency.

The objective of this thesis is to propose a method for extrapolating the characteristic curves of turbocharger turbine performance maps (flow and efficiency curves). This extrapolation method will be based on standard characteristic curves (supplied by the manufacturer) and on a digital test bench (CFD) to perform calculations on turbochargers of different categories: radial or mixed turbochargers, axial turbines for industrial and marine applications. The method developed will be validated by tests carried out on the laboratory test benches.

Concerning radial or mixed turbines, an in-depth study will be carried out on low and negative flow operating zones to explain the behavior of the turbine which then behaves like a compressor.

Particular attention will be paid to the operation of pulsed-feed turbines, the modeling of which requires knowledge of extended characteristic curves.

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Candidate sought:

Master or engineer with good foundations in thermodynamics and fluid mechanics.

Motivation for research and technique

Interest in thermal machines and CFD