MULTIPOINT OPTIMISATION OF A 2D COMPRESSOR WITH SPLITTERS FOR A MICRO-GAS TURBINE APPLICATION

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Power MEMS has become an interesting and challenging research area. In this project, an optimisation method, which combines, CFD, neural networks and genetic algorithms, has been applied for the aero-thermal design of the compressor impeller for a micro engine. The design makes use of splitters and includes the off-design study.

Since the manufacturing technique forces to use planar geometries, only the blade shape can be used to control the area increase and to provide good aerodynamic performance. Additional aero-thermal challenges result from scaling:

- Re is 100 times smaller than in a conventional engine. Flow in micro compressors is very susceptible to separation.
- All the components are very small and close together, which causes a massive heat transfer from the combustion chamber and turbine to the compressor. Considering that at micro scale, conduction is much bigger than convection, the structure is expected to be almost isothermal.

The high number of optimisation parameters chosen (14), as well as the complex cost function used, give an idea of the difficulty of the centrifugal compressors design, and justify the necessity of a robust optimisation system as design tool.

First, optimisation without taking into account the heat transfer has been carried out, which has allowed the validation of the method. The Mach number distribution along the blade and the splitter is shown in Figure 1. Heat transfer was introduced in a second case proving that it affects strongly to the performance, as it can be seen in Figure 2.

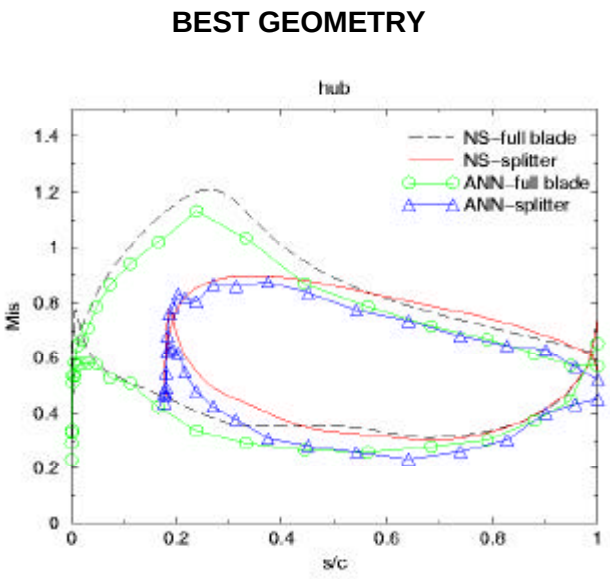

Figure 1: Isentropic Mach number distribution adiabatic computation

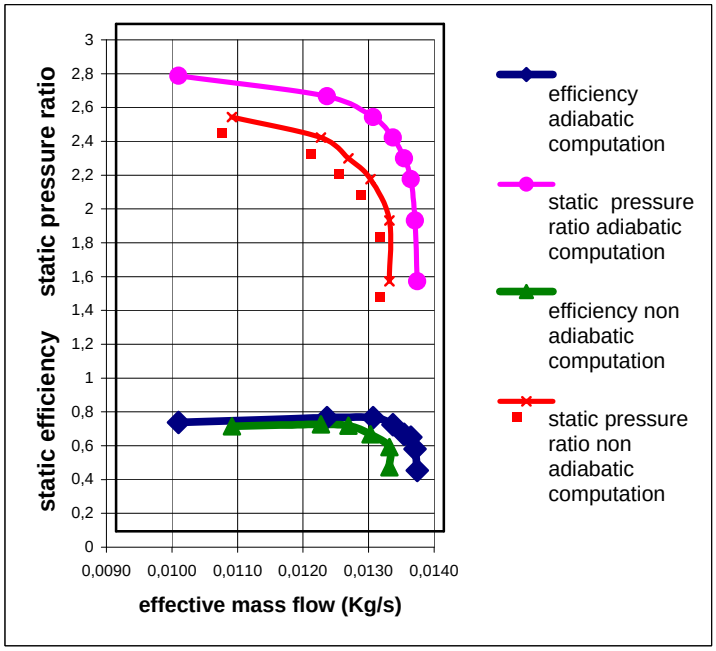

Figure 2: Performance map for the adiabatic and non adiabatic computation