COOLFluiD FOR TURBOMACHINERY APPLICATIONS

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COOLFluiD is a computational object oriented library to be used to simulate fluid mechanics related phenomena. Up to now into COOLFluiD a lot of plugins are implemented in order to allow a user to simulate many different problems concerning the field of fluids. This project aims to extend the current Finite Volume solver in COOLFluiD to deal with turbomachinery applications where specific problems occur, that are not present in other areas.

In this project we have developed and implemented some of the algorithms necessary to deal with these problems. In particular we dealt with typical turbomachinery boundary conditions, like outlet and periodic boundary conditions. For the former we have developed and implemented several constant value conditions and the average isentropic Mach number condition as well. For the periodicity condition we have developed and implemented algorithms for 2D and 3D cases. Moreover following the paradigm of High Performance Computing the algorithms are targeted to make parallel computations and are written in object oriented fashion. Many different testcases have been done in order to validate the implementations. Numerical and experimental results have been compared and they show a good agreement. Figure 1 shows a comparison between experimental and numerical solution for the CT-2 cascade.

Thanks by the work done in this project it is now possible to simulate with COOLFluiD a turbomachinery cascade. Of course a lot of work still need to be done in order to simulate more complex turbomachinery aspects, like secondary flow and stator-rotor interaction.

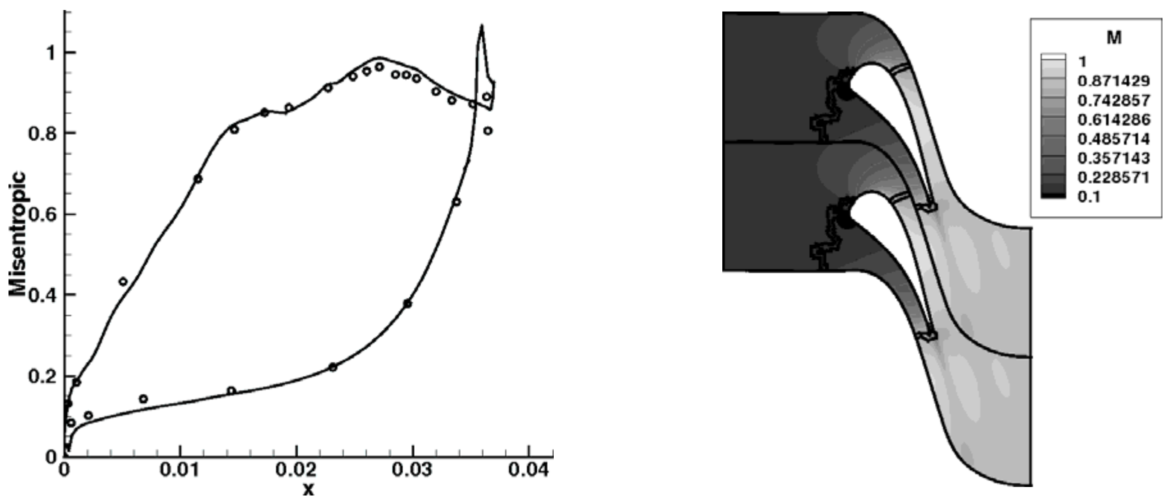

Figure 1: CT-2 cascade, inlet conditions:** P_{tot} **= 143500 Pa,** T_{tot} **= 410 K, α = 0°; outlet condition:** $M_{AVE, is}$ **= 0.84; wall condition:** T_{tot} **= 293.48 K. (a) Isentropic Mach number along blade obtained experimentally (points) and numerically (solid line). (b) Mach contour obtained by a parallel simulation with three processes.