

Boundary layer control in the vaned diffuser of a radial flow turbomachinery

The aim of the Thesis is to associate the skills existing in the lab in the field of flow control and rotor stator interaction in order to reduce the fluctuating detachment existing in the vanes of a radial flow pump diffuser to control their effects.

The project will involve two consecutive steps:

- Control strategy definition (position, number et optimal operating range of sensors and actuators). This strategy will be defined taking into account the analysis of experimental data and the use of passive vortex actuators.
- Active control device conception and evaluation of its efficiency.

Modern measurements techniques developed in the research team (stereoscopic PIV, high repetition rate PIV) will be used in this project.

Scientific context

The turbomachinery performances, far from their design operating conditions, and especially at part load are negatively affected by the development of unsteady phenomena that may cause damage and noise. These phenomena are linked with a bad fluid incidence at impeller or diffuser inlet which leads to boundary layer detachment on the vane walls. In case of a vaned diffuser, the detached zone can fluctuate with fluctuating upstream flow coming out of the impeller.

GENERAL TOPIC: Fluid Mechanics - Turbo-machinery – Pumps

The PhD Thesis will take place in the Research Team of the Laboratoire de Mécanique de Lille which deals with « turbulent and rotating flows ». This team is working on the experimental and numerical characterisation of turbulence, and especially of wall turbulence. It has, for a few years, developed research in the field of flow control in a boundary layer in an adverse pressure gradient.

On the other hand, this team is also working on turbomachinery, with a strong experimental activity in the field of rotor-stator interaction in radial flow pumps.

Finally, the team is also one of the European leaders for the development of Particle Image Velocimetry. A great amount of metrological facilities are available in the optical metrological platform Meol (www.meol.cnrs.fr).

Candidate profile

The candidate should hold a Master of Science or equivalent diploma in Fluid Mechanics.

Motivation for experimental work is necessary.

Good skills in programming (C, C++, fortran) would be advantageous.

Language : English.

Advisors :

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Application:

Please send application form and materials to Mr. Yvon VELOT

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