AERODYNAMICS AND ACOUSTICS OF CONFINED FLOWS

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Noise nuisance is one of the most important problems in today's technological society and the reduction of noise pollution is becoming a more important challenge. One of the most important noise sources encountered is flow induced sound. In particular to this project is the sound generation within confined flows of mufflers and ducted fans. As such, there is a need to investigate these flows to identify the source of the noise. This PhD is part of a IWT project, called CAPRICORN, dedicated to the development and validation of prediction tools for aerodynamic noise of confined flows. The primary goal of this PhD is to obtain accurate hydrodynamical and acoustical experimental data for the understanding of the noise sources and validation of the numerical prediction tools. For each of the configurations considered (muffler and ducted fan), Particle Image Velocimetry (PIV) is used to identify the mean and fluctuating components and hot-wire measurements are performed to get velocity profiles and time evolution and spectrum of the velocity. Microphones and wall mounted unsteady pressure probes are used to provide the radiated sound.

A new simplified fan has been designed based on the CD airfoil cooling fan of Valeo Thermal Systems. In addition, a facility is designed such that aerodynamic and acoustic measurements can be made in a unique, well controlled experimental environment. Preliminary aerodynamic tests were carried using PIV on a rotor-stator configuration to study the flow behaviour and interaction of the stator wake with the passing rotor blade. The measurements are conditionally sampled to observe the wake behaviour at different positions of the blade passage.

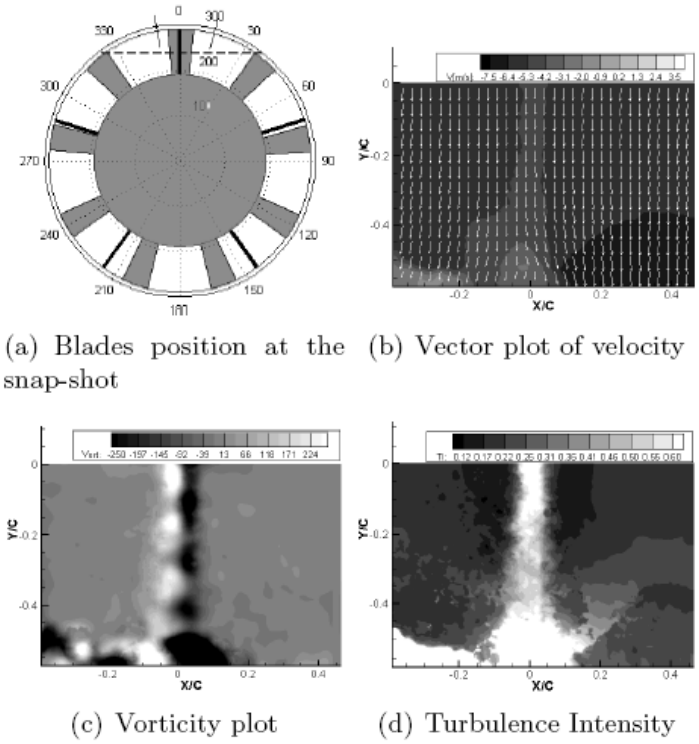

Figure 1: Velocity, vorticity and turbulence intensity contour maps for the 9 bladed rotor as the blade passes beneath the stator