FACHHOCHSCHULE DÜSSELDORF
UNIVERSITY OF APPLIED SCIENCES
www.fh-duesseldorf.de

Strömungstechnik und Akustik

Prof. Dr.-Ing. Frank Kameier

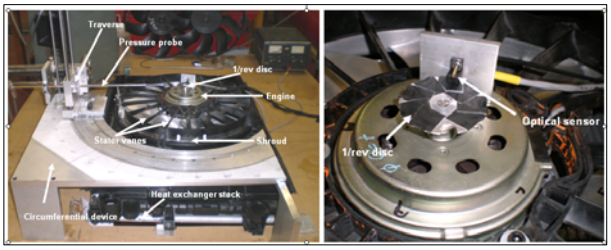
Experimental Investigation of an Automotive Axial Flow Fan

Student : Robert Heinze

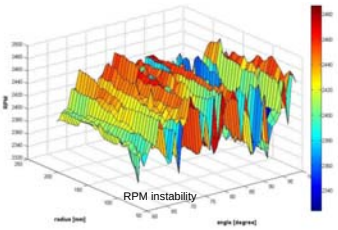
What is it all about ?

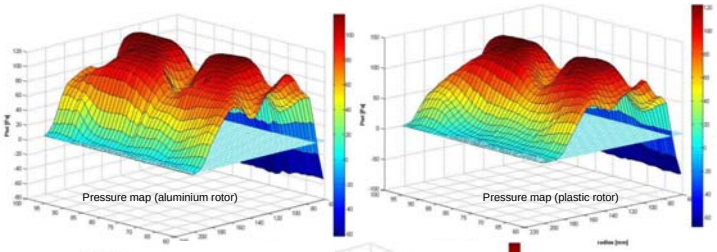
This Bachelor thesis is about the investigation of the flow wake of an automotive cooling fan system by means of pressure and velocity measurements.

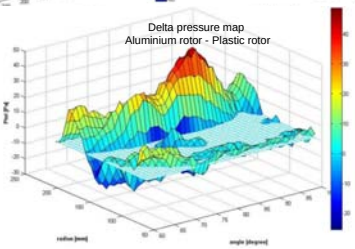
Experimental set-up



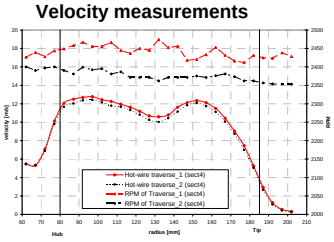
RPM & Pressure measurements







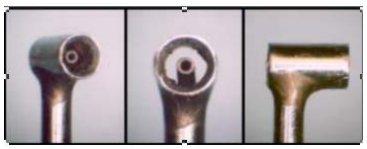
Velocity measurements



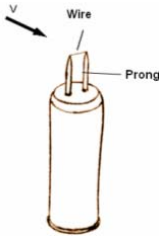
Objective

- Correction of the measured pressure due to the RPM instability of the cooling engine
- Investigation of the pressure differences between a common plastic rotor and an equal shape aluminium one in terms of deflection
- Validation of previous CFD, PIV, velocity and pressure measurements in different fan sectors

Kiel Probe for pressure measurements



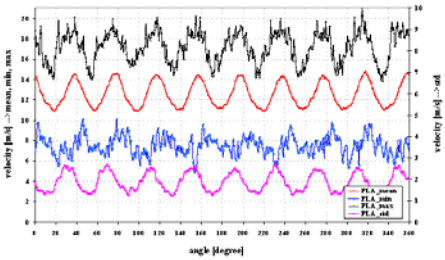
Single sensor Hot-Wire
for velocity measurements



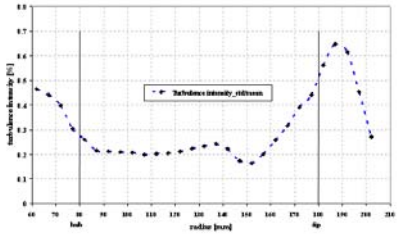
Motivation

In times of globalization and rising energy costs it becomes more and more important to develop low-priced equipment of high quality and low energy consumption. By considering that the mobility and thus automotive traffic will continue to increase, this industry sector has a huge challenge in enhancing their products. Due to the limited efficiency of combustion engines, a large amount of energy (in the form of heat) brought in by the fuel must be dissipated. This happens primarily by means of automotive cooling systems, which need to secure a sufficient cooling also under extreme operating conditions. Increased engine performance and extended equipment cause higher requirements on cooling systems. By considering that a fan working at full power consumes a remarkable amount of the fuel energy, it is important to understand how it works to increase the efficiency. The design of the cooling system is limited by the available space in a car. Furthermore the manufacturing costs of complex cooling systems need to be justified by economical aspects. The rotor-stator interaction is unsteady and can have a major influence on both the aerodynamic and acoustic performances on the fan systems. In order to optimize the efficiency of their automotive cooling fan systems the company Valeo wants to obtain as completely as possible all the information concerning the flow characteristics. Therefore CFD simulations and different kinds of experiments (like in this thesis) are necessary to visualize and understand the behavior of the flow through the fan.

Phase-locked average results



Turbulence intensity level



Location: Von Karman Institute for Fluid Dynamics

Chausseé de Waterloo 72, Belgium, http://www.vki.ac.be/