VELOCITY AND TURBULENCE MEASUREMENTS IN A BLOWDOWN TURBINE TEST RIG

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The hot wire anemometry technique is used to perform turbulence and velocity measurements in a turbine. Hot wires are often used in low speed flow and in absence of large temperature variations. In this project, the technique is used in a blowdown wind tunnel where large changes of density and temperature occur and under high velocity.

Dedicated hot wire - thermocouple combined probes were manufactured for the turbine test rig. Preliminary tests were performed in a jet facility to calibrate the probes as a function of velocity and gas temperature and to identify the impact of transient conduction between the wire and its supports. These preliminary tests also allowed to develop the data processing routines to evaluate velocity and turbulence in such environment.

The measurements were carried out in the test rig in one-and-half stage configuration. Probes were placed upstream and downstream of the turbine stage as well as downstream of the second stator. Stage inlet measurements allowed the determination of the velocity, turbulence level and length scale. Downstream of the rotor and downstream of the second stator, the measurements allowed to quantify the magnitude of the periodic velocity fluctuations due to rotor blade passing events, as well as the turbulence level.

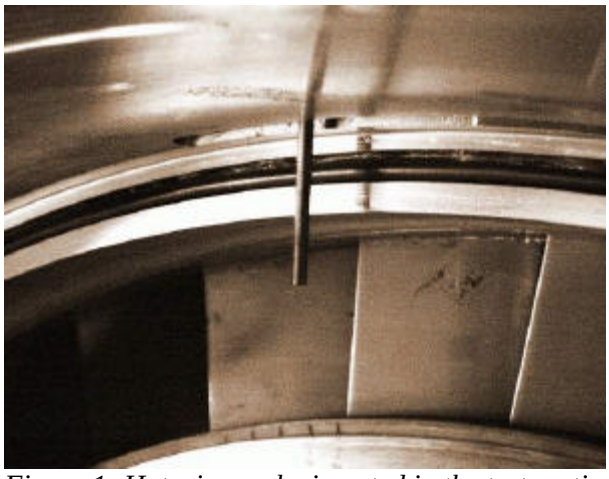

Figure 1: Hot wire probe inserted in the test section

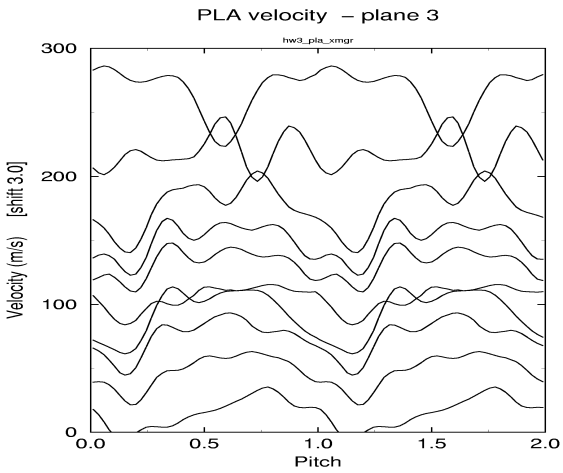

Figure 2: Velocity fluctuations measured downstream of the rotor at several channel heights: abscissa: rotor passing events, ordinate of traces was shifted according to the height of the measurement in the channel