Proposal 2015-2016

Topic #4 - Design of wind tunnel turning vanes: experimental and computational analysis

Contacts

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Context

The design of high quality wind tunnels requests a full understanding of the aerodynamic flow through its components. Amongst others, turning vanes are located in the corners of the tunnel to ensure a smooth passage of the flow. Their role is double: reduction of the pressure losses to limit the required power of the driving fan and improvement of the quality of the flow field at the location of the model to be tested.

The company AEM aero has an important experience in the design and construction of subsonic aerodynamic wind tunnels. This task is performed through experimental (test-bench) and numerical (Computational Fluid Dynamic - CFD) analysis, leading to the best geometry for a given type of aerodynamic application.

Objectives

The objective of this final year project is to improve the methodology for the design of turning vanes. Therefore, a test bench (wind tunnel segment) will be designed which enables a modular testing of turning vanes including measurements and analysis.
The bulk of the work will be carried out at the company site during the second academic semester (Feb. - May 2016)

The internship includes the following tasks:

- Literature survey about low subsonic aerodynamic wind tunnels and turning vane design.
- Aerodynamic Design and conceptual layout of a novel test-bench for characterization of the turning vanes: choice of the blowing or suction type, sizing the structure and airspeed control.
- Definition of all required hardware to build the test bench.
- Instrumentation of the test-bench: definition of interfaces and data acquisition.
- Definition of the performance of the turning vanes (aerodynamic criteria, measurement types and data reduction).
- Establishment of the testing procedures.

The Master thesis will consist in:

- Literature survey research about CFD models for internal aerodynamics (subsonic regime).
- Modelization of the turning vanes segments using a CFD tool (OpenFOAM is preferred).
- Comparison of CFD results with experimental data from a complete wind tunnel recently commissioned by AEM.
- Parametric study of the turning vanes geometry

The interest of this combined Master Thesis / Internship is to carry out a study on a methodology to test and improve turning vane aerodynamics including a numerical analysis.