Faculty Engineering Technology
Program Sustainable Energy Technology

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

David Engler Faleiros

will give a presentation, entitled:

PIV Investigation of Open-Jet Wind Tunnel Flow around an Airfoil

Date: Friday July 10, 2015

Time: 13:00

Room: **Horst Building Room N.109**

Summary:
An important factor in the design and use of wind turbines is the noise hindrance caused by the interaction of the blades of the wind turbine with the air. Attaching serrations to the blade trailing edge can reduce the emission of noise. These attachments, however, should not negatively affect the aerodynamic performance of the turbine, which would cause it to harvest less energy from the wind. The aerodynamic and aeroacoustic performance of trailing edge inserts are commonly tested on 2D airfoils in wind tunnel facilities.

Acoustic experiments with microphone arrays are usually performed in open-jet wind tunnels, in which reflections of noise from the walls and interaction of the microphones with the flow are avoided. On the other hand, most aerodynamicists prefer the use of wind tunnels with a closed test section, with low free stream turbulence intensity, which most faithfully simulating free flow conditions. To enable both acoustic and aerodynamic measurements in an open jet facility, the accuracy of the determination of the aerodynamic characteristics in open-jets must be improved, especially for the determination of the drag.

The present study considers measurement of the flow around a 2D airfoil configuration in an open-jet facility with Particle Image Velocimetry (PIV). Velocity and pressure fields around the airfoil are compared with results from potential flow solutions (XFOIL). Transition of the boundary layer on the airfoil is determined via oil flow visualization. The forces on the airfoil are obtained from the flow field measurements around the airfoil utilizing control-volume analysis. Furthermore, a novel approach is presented to calculate drag, lift and effective angle of attack from the wake of the airfoil at 1.75 chord lengths downstream of the airfoil.

The drag obtained from the wake analysis has been compared with results from measurements in a closed test-section carried out in another facility. A difference in drag coefficient of no more than 9% has been found. Finally, this method has been used to assess drag and lift from a 2D airfoil with and without serrations and provide an evaluation of its aerodynamic performance.

Assessment committee: **Chairman,**

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