Faculty Engineering Technology
Program Sustainable Energy Technology

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

A.J.C. Westenberg

will give a presentation, entitled:

Investigation of Flat-Back DU 97-W300 Airfoil in Open-Jet Wind Tunnel

Date: Friday September 25, 2015

Time: 09:30

Room: **Horst Building Room ZH.286**

Summary:
In the search for alternative sources of energy, wind energy is increasingly becoming an important alternative of choice for renewable source of energy over conventional centralized energy production. In order to achieve higher efficiency and keep costs low, output ratings per wind turbine have increased considerably in the last decade. Because of this rotor size increases and as an effect loads increase, which gives cause for research on rotor designs that can handle higher loads and on active flow control that favorably affect performance and loads. Rotors with flat back airfoils at the root of the blades are a good example of the first. It forms the main topic of the present research.
A flat back airfoil designed by Barone (2009) based on the DU 97-W300 airfoil has been tested in the anechoic wind tunnel of the Engineering Fluid Dynamics group of the University Twente, at Reynolds numbers up to approximately one million.

As a fast and relatively cost effective alternative for a conventional aluminum wind-tunnel model, polyurethane foam (Sikablok M700) has been used for the wind-tunnel model. The airfoil has a chord of 250 mm and a span of 900 mm. The production of the Sikablock airfoil proved to be successful, it is easily processed and after some low intensity sanding a high surface quality was accomplished. The model is also much lighter than a conventional aluminum model and therefore easier to install and handle compared to an aluminum model.

At the University Twente's anechoic wind tunnel facility combined lift and drag measurements were only possible by equipping the model with pressure taps and carrying out measurements with a wake rake. This is a time consuming process. In this present study the design of a load balance for 2D wind-tunnel models has been pursued. A three way measuring balance has been designed based on the earlier design of Ruben de Boer (2013). In the resulting set-up the model is mounted horizontally with a disc rotation mechanism driven by a linear actuator. A PID-controlled system can set the angle of attack of the model, employing the rotational discs, with a precision of 0.5 degree. The balance has been designed to be installed on the rotation discs and is capable of measuring loads up to 300 N in axial direction, 1000 N in normal direction and a pitching moment of 120 Nm, including the weight of the model.

Furthermore the use of an acoustic array has been investigated, to study whether trailing edge noise can be measured in the present setup. It proved that the test section can easily be fitted with an acoustic array. A microphone array was used with 48 microphones. It was found that the present, acoustically hard walls are causing reflections of the noise that causes artificial noise sources in the measurements. By isolating the top part of the test section and repositioning the microphone array this was reduced to a minimum, providing a workable level of reflections.

Assessment committee: **Chairman,**

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Prof.dr.ir. H.W.M. Hoeijmakers (mentor)
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