Faculty Engineering Technology
Program Sustainable Energy Technology

University of Twente.

COLLOQUIUM

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Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

Stephanus Michael Dwiprasetyo Widjanarko

will give a presentation, entitled:

Active Aero-Fluidic Load Control on Wind Turbine Blades

Date: Friday August 26, 2011

Time: 14.00

Room: Horstring C101

Summary:
The rotor size of modern horizontal axis wind turbines has been steadily increasing over the past years. As the rotor size increases, the fatigue loads of the wind turbine become one of the key issues. Reducing the fatigue loads leads to lower cost of the total wind turbine life cycle. Nowadays, the most advanced technique to control the loads is individual blade pitch control. However, the large size of the blades may limit the speed of the pitch actuator. Moreover, a more distributed load control system is necessary to handle local flow variations on the blade. To tackle this issue, several research programs in wind turbine communities have focused on so-called smart rotor blades. In the present study, the use of synthetic jets to control the load on wind turbine blades is investigated. The jets are introduced at a location near the trailing edge. This type of flow control affects the circulation of the airfoil and therewith its lift.

A non-rotating blade with a NACA0018 cross-section, in a 2D set-up, with flow control is investigated in University of Twente silent wind tunnel. In the study the aerodynamic behavior of the blade is investigated in absence of the flow control first in order to establish the base line. Surface pressure measurements have been performed to quantify the airfoil performance as function of angle of attack for a number of Reynolds numbers. Subsequently, a parametric study has been carried out to investigate flow control with the synthetic jets operating at different frequencies and outflow velocities. The parametric study has been performed at 0^o angle of attack and at an angle of attack near the design point for this airfoil. The results from the wind tunnel experiment are compared with the results from the numerical simulation employing a computational method solving the Unsteady Reynolds-Averaged Navier Stokes (URANS) equations.

Assessment committee: **Chairman:**

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d.d.