Opleiding Werktuigbouwkunde

Universiteit Twente
de ondernemende universiteit

COLLOQUIUM

Conform artikel 4.6.8 van het SSNS-wb.

Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

Christian Simon Boeije

een voordracht houden getiteld:

Pitch Angle and Flow Separation Control for a Wind Turbine Airfoil

Datum: **30 mei 2008**

Tijd: **14:00 uur**

Zaal: **HR N109**

Summary:
This study constitutes a step towards the development of a wind turbine with a constant level of aerodynamic performance under time-dependent wind conditions in terms of flow velocity and direction. To this end several methods of flow control have been addressed both experimentally and numerically for a wind-turbine like airfoil: the NACA0018 airfoil section. Initial measurements and results of numerical flow simulations for the airfoil without flow control have shown a satisfactory agreement in terms of surface pressures. This indicates that both methods are capable of obtaining reliable results for this base case. Continuous blowing is the first, and most widely discussed, method of flow control investigated in this study. A pressurized air system has been used to create a continuous injection jet. Two different injection locations have been investigated. Using an injection slit near the trailing edge of the airfoil can significantly alter the pressure distribution on the airfoil and hence its aerodynamic performance. Numerical simulations have shown that the lift coefficient can be increased by 0.4 which is tantamount to increasing the angle of attack (pitch angle) by about $4°$. An injection slit positioned at the mid chord has been analysed as well. By using continuous blowing at this location the performance of the airfoil in terms of lift is reduced since due to the blowing the flow is forced to separate from the airfoil. This injection location has also been used as a means to alleviate flow separation. This has been attempted by rounding the downstream edge of the injection slit, which forces the jet to remain wall-bounded which adds momentum to the boundary layer.
In addition to continuous blowing, flow control using synthetic jet actuation has also been explored. Numerical simulations using synthetic jet actuation have shown that, when attempting to delay flow separation, this method is more effective than continuous blowing.

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