



COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his Bachelor assignment

Jeffrey Hagen

will give a presentation, entitled:

Optimization Study of a Single Dielectric Barrier Discharge Plasma Actuator

Date: Friday 16 September 2011

Time: 15.00

Room: OH 110

Summary:

In recent years there has been much interest in the development of active flow control in the field of aerodynamics. One of the new promising technologies for flow manipulators is the plasma actuator. The Single Dielectric Barrier Discharge (SDBD) plasma actuator studied is based on local ionization of air to produce a body force field that induces a velocity field. Preliminary research studies have shown promising results regarding aerodynamic performance, such as adjustment of the local pitch angle in different sections of the wing and load reduction on the wing. The work presented describes the influence of the plasma actuator on the boundary layer.

Theoretical work has been conducted to obtain insight in plasma actuators. In order to optimize the SDBD plasma actuator, several parameters and the geometry of the plasma actuator have been examined.

In order to examine the physics behind the phenomenon of plasma induced wind experimental work has been conducted on a plasma actuator by means of electric, heat and Pitot-tube velocity measurements in still air. Moreover, the velocity profile of the induced wall jet has been examined, from which the so-called jet parameter is obtained, which characterizes the induced wall jet as a function of the input power and frequency. Subsequently, boundary layer manipulation of the SDBD plasma actuator is investigated by means of Pitot-tube velocity measurements in the flow over a flat plate in the silent wind tunnel.

The study shows that the current plasma actuators are useful for boundary layer manipulation and thus flow control. However, the existing SDBD plasma actuator is not powerful enough for high free stream velocities making its usability limited. Fortunately, there is much space for further improvement that could eventually lead to application in flow control.

Assessment committee:

Chairman,

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d.d. _____