*Faculty Engineering Technology*
*Program Mechanical Engineering*

UNIVERSITY OF TWENTE.

# COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

## R. Kommer

will give a presentation, entitled:

## An Exploratory Study of a Linear Plasma Synthetic Jet Actuator

**Date: Friday February 7, 2014**

**Time: 14:00**

**Room: Horstgebouw N.109**

**Summary**:
Flow control with the use of plasma actuators is a relatively new area of research that, however, is rapidly expanding. An actuator configuration that can be used is the linear plasma synthetic jet actuator (L-PSJA). An L-PSJA basically consists of three thin electrodes and a dielectric material. One of the electrodes is embedded in the dielectric material and is grounded. The other two electrodes are mounted on the upper side of the dielectric, starting at the two edges of the embedded electrode. These two electrodes are exposed to the air stream over the surface. By applying a high voltage, high frequency signal to the exposed electrodes, a plasma will form in the air above the embedded electrode. The movement of ions in the plasma, from the exposed electrodes to the surface of the dielectric, will cause a so-called ionic wind or wall jet from each of the exposed electrodes. These induced air flows are in opposite directions. At the location where the opposing wall jets collide, a jet perpendicular to the dielectric surface is formed.

Although the basic concept of plasma actuators is well-known, as explained above, the detailed physics of the plasma actuator is not yet fully understood. Therefore, it is difficult to optimize plasma actuators both numerically and experimentally. In this study an effort has been made to implement changes to the phenomenological Suzen-Huang model, in order to realize a model that is closer to physics. In the Suzen-Huang model the effect of the plasma on the flow is represented by a volumetrically distributed body force.

In addition an experimental set-up has been designed and realized. Employing this set-up it has been investigated how the produced body force is influenced by variation of the electrical parameters, i.e. the AC amplitude and the frequency of the voltage. In the experimental set-up the plasma actuator has been placed on a weighing scale. This provides the possibility of directly reading out the weight difference for situations with and without applied voltage signal. The power consumption of the plasma actuator has been measured by direct measurements of the applied voltage and indirect measurements of the current. Ozone production measurements have been performed in order to investigate whether a prediction can be made of the rate of ozone production and decay.

**Assessment committee:**
Prof.dr.ir. H.W.M. Hoeijmakers (chairman/mentor)
Dr.ir. N.P. Kruyt
Dr.ing. H.M.J. Bastiaens
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**Chairman,**

d.d. 23-01-2014

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