

# COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his Bachelor assignment

**Joris Janssen**

will give a presentation, entitled:

## **Experimental Study of Relationship between Thrust and Induced Flow Velocity for Linear Synthetic Jet Plasma Actuator**

**Date: Thursday March 5, 2015**

**Time: 14:00**

**Room: Horst Building Room N 229**

### **Summary:**

A relatively new but rapidly emerging area of interest in flow control research is the application of plasma actuators to generate synthetic jets. The linear synthetic jet plasma actuator (LSJPA) combines two single dielectric barrier discharge (SDBD) actuators and consists of one electrode embedded in the dielectric material and two electrodes mounted on the upper surface of the dielectric material. A high-voltage, high frequency signal is applied to the exposed electrodes, while the embedded electrode is grounded. This results in ionization of the surrounding fluid, i.e. the formation of a plasma above the embedded electrode. The movement of ions in this plasma transfers momentum to the surrounding fluid, inducing airflows in opposite directions at each exposed electrode. The induced airflows collide at the dielectric material's center, resulting in the formation of a perpendicular jet.

The aim of this study is to investigate and identify the relationship between the amount of thrust generated by a LSJPA plasma actuator and the induced jet velocity. In prior research, no relation was found by theoretical investigation. This study focuses on experimental methods to investigate this relationship.

To investigate this relation, simultaneous measurement of thrust and velocity is necessary. An experimental setup based on the setup already present at the University of Twente was designed and realized. This setup allows velocity measurements by utilizing a pitot tube and a pressure difference transducer to directly determine the velocity in the induced jet.

Experiments have been performed to investigate the influence of input parameters such as voltage and frequency on thrust, velocity and power consumption of the actuator. The experimental setup proved to be effective in simultaneous measurement of velocity and thrust. The results of the experimental work show that thrust, velocity and power are dependent on the applied signal. An approximation of the applied signal was found by fitting experimental data. An approximation of the jet velocity as a function of the applied signal was found, however, the relatively large error of measurement in the thrust prevents ascertaining a relationship between velocity and thrust. An approximation to this relationship was obtained, however, which shows that the relationship between velocity and thrust for low voltages can be approximated by a power law function.

### **Assessment committee:**

Prof.dr.ir. H.W.M. Hoeijmakers (Mentor/Chairman)  
Prof.dr.ir. A. de Boer (External Member)  
Ir. R. Kommer (mentor)

**Chairman,**

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