

# COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his Bachelor assignment

**Peter Puttkammer**

will give a presentation, entitled:

## **Boundary Layer over a Flat Plate**

**Date: Wednesday July 3, 2013**

**Time: 12:30**

**Room: Z 109**

### **Summary:**

Air flowing past a solid surface will stick to that surface. This phenomenon – caused by viscosity – is a description of the no-slip condition. This condition states that the velocity of the fluid at the solid surface equals the velocity of that surface. The result of this condition is that a boundary layer is formed in which the relative velocity varies from zero at the wall to the value of the relative velocity at some distance from the wall.

The goal of the present research is to measure the velocity profile in the thin boundary layer of a flat plate at zero angle of attack at Reynolds numbers up to 135,000, installed in the Silent Wind Tunnel at the University of Twente. The measured velocity profiles are compared with results from theory.

In the present study this boundary layer is investigated analytically, numerically and experimentally. First, the boundary-layer equations are derived. This derivation and the assumptions required in the derivation are discussed in some detail.

Second, the boundary-layer equations are solved analytically and numerically for the case of laminar flow. The analytical similarity solution of Blasius is presented. Then approximation methods are carried out and a numerical approach is investigated. These calculations showed that the numerical approach yields velocity profiles that are very similar to Blasius' solution.


Third, velocity measurements have been carried. Hot Wire Anemometry is used to measure the velocity profile inside the boundary layer along the flat plate. A flap at the trailing edge of the flat plate is used to ensure that leading edge of the plate is at zero degree angle of attack. From the experiments it is concluded that the measured velocity profiles fit Blasius' solution. Therefore Hot Wire Anemometry can be used for measuring the velocity distribution within the boundary layer.

### **Assessment committee:**

Prof.dr.ir. H.W.M. Hoeijmakers  
dr.ir. W.K. den Otter  
dr.ir. R. Hagmeijer

(Mentor/Chairman)  
(External Member)

**Chairman,**

  
d.d. 19-06-2013