



COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his Bachelor assignment

Remco Olimulder

will give a presentation, entitled:

The boundary layer of a fluid stream over a flat plate

Date: Thursday Januari 31, 2013

Time: 15:00

Room: Z 203

Summary:

In the flow over a solid surface a boundary layer is formed. In this study this boundary layer is investigated theoretically, numerically and experimentally. The equations governing the incompressible laminar flow in thin boundary layers have been derived following Prandtl's theory. For the case of two-dimensional flow along an infinite flat plate at zero incidence, the similarity solution of Blasius is formulated. In addition the similarity solution for the flow stagnating on an infinite flat plate has been derived.

Subsequently the Integral Momentum Equation method of von Kármán is derived. This method is then used to numerically solve for the flow in the boundary layer along the flat plate and for the stagnation-point flow.

For the experimental part of the investigation a wind-tunnel model of a flat plate, of finite thickness, was placed inside the silent wind tunnel. The leading-edge of the wind-tunnel model has a specific smooth shape, designed such that the boundary layer develops like the boundary layer along a plate of infinitesimal thickness. The pressure distribution along the wind-tunnel model, obtained from a CFD calculation has been used as input for the Integral Momentum Equation method to predict the boundary layer development along the model and compare it to Blasius' solution.

The velocity distribution in the boundary layer has been measured using hot-wire anemometry (HWA) at three distances from the leading edge. The data is obtained for three values of the free-stream velocity: 2 m/s, 5m/s and 10m/s, corresponding to different values of the similarity parameter of the boundary layer flow, i.e. the Reynolds number.

The measured velocity profiles are checked on similarity and are compared with the calculated data.

Assessment committee:

Prof.dr.ir. H.W.M. Hoeijmakers
Dr. R. Luttge
Ir.H. de Vries

(chairman)
(mentor)

Chairman,

d.d. _____