Faculty Engineering Technology
Program Mechanical Engineering

University of Twente.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

Sander Guido Baaren

will give a presentation, entitled:

A Theoretical and Numerical Approach to the Aerodynamics of Two-Dimensional Flow about Flapping Wings

Date: Friday, Februari 24, 2012

Time: 14:00

Room: Zuidhorst 286

Summary:
Bird-like flapping wing robots can be used for various applications, such as observation purposes or herding flocks of birds away from airports. In order to obtain insight in the practicality and economic feasibility of such a robot-bird, it is necessary to be able to predict the aerodynamic characteristics, such as lift and thrust, of wings in flapping flight. The present research is part of a project that will ultimately lead to a method for the prediction of the aerodynamics of the three-dimensional flow about flapping wings of bird-like robots.

The research presented concerns the analysis of the two-dimensional flow about flapping airfoil sections using a theoretical and a numerical approach. The classical unsteady thin airfoil theory for flapping airfoils is derived and used to predict the aerodynamic characteristics of flapping wing motion. ANSYS CFX, a Computational Fluid Dynamics (CFD) software package that solves the Reynolds-Averaged Navier-Stokes equations, is used to numerically simulate the flow about flapping airfoils. For this purpose a dynamic mesh has been devised for a moving airfoil section in a wind tunnel.

For the flow about stationary airfoils results obtained with CFX are compared with solutions obtained using XFOIL, a potential-flow method coupled to an integral boundary-layer method. For flapping airfoils results from numerical simulation obtained employing CFX are compared with results from the unsteady thin airfoil theory.

Assessment committee: **Chairman:**

Prof.dr.ir. H.W.M. Hoeijmakers (chairman/mentor)
Prof.dr.ir. A. de Boer
Dr.ir. N.P. Kruyt
Dr.ir. R. Hagmeijer
Ir. S.H. Jongsma

d.d.