Faculty Engineering Technology
Program Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

A.J. Bosscha

will give a presentation, entitled:

Multi-Level Wave-Ray Solver for 2D Helmholtz Equation

Date: Friday August 22, 2014

Time: 14:00

Room: **Horst Building Room NH.205**

Summary:
The Helmholtz equation is a partial elliptical differential equation that describes standing waves. The amplitude of standing waves is only space-dependent and independent of time. The Helmholtz equation is widely used in acoustics, mechanics, and thermodynamics.

Often the Helmholtz equation is considered on (semi-)indefinite domains. Because of the domain size the range of wavenumbers to be considered is large. In this case of an indefinite domain a solution with a large number of sine and cosine waves has to be included. When solving the Helmholtz equation numerically many grid points are required to resolve all sinusoidal wave components.

Iterative methods can solve these problems, but these methods are computationally expensive for problems with a large number of grid points. A method to cope with this problem is to use a Multi-Level algorithm. Multi-Level algorithms make use of coarser grids to speed up the convergence process on the target grid. For the Helmholtz equation, however, standard Multi-Level algorithms fail to work. A specific range of error components is insensitive to the local relaxations carried out within the Multi-Level algorithm.

Based on the work of Brand and Livshits an additional cycle is added to the algorithm. This ray-cycle removes the error components that standard Multi-Level techniques fail to remove. In the present research a Wave-Ray algorithm is constructed for the two-dimensional non-homogeneous case of the 2D Helmholtz equation. To check the suitability for applications in engineering, the algorithm has been assessed in various ways.

Assessment committee: **Chairman,**

Prof.dr.ir. H.W.M. Hoeijmakers (chairman)
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