Faculty Engineering Technology Program
Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

Daniël ter Haar

will give a presentation, entitled:

Potential flow theory for ship wave interaction

Date: 21-10-2016
Time: 10:30
Room: NH 207

Summary:

In solving a ship's motion, the interaction between the ship's hull and the sea is quite important. The ship is actuated by the sea waves whereas the motion of the ship itself influences the velocity field of the sea, which makes it a coupled problem. Whereas conventional simulation packages are capable of solving the motion of the ship and the velocity field of the sea separately or alternately, the goal is to derive a method that can solve the equations of motion directly.

In the equations of motion, the force by the sea on the ship consists of two parts; a force due to incoming waves and a reaction force due to the ship's motion. The incoming waves are considered to be the forcing function of the equations of motion. The reaction force is proportional to the velocity and acceleration of the ship and can be considered as "added mass and added damping" which will modify the mass and damping matrix in the equations of motion. In order to calculate the incoming wave force, the added mass and added damping coefficients, the differential equation and boundary conditions that govern the flow are derived.

Using the appropriate assumptions, the fluid's governing equations are approximated by a potential flow model. The velocity field's partial differential equation is linear, but the boundary conditions appear to be nonlinear. After expanding the nonlinearities in a series, a linearized boundary value problem remains which is solved by superimposing solutions.

The linear boundary value problem is split into three parts; the undisturbed wave potential, the diffraction potential and the radiation potential. The undisturbed wave potential is solved rather easily due to homogeneous boundary conditions. The diffraction and radiation potentials need to satisfy an inhomogeneous boundary condition as well, which results in calculation of an integral over the extended Green's function. This extended Green's function is derived both for infinite and finite depth. Since the resulting integral cannot be calculated analytically, it is replaced by a discrete approximation, which results in solving the diffraction and radiation potential boundary value problems by means of a panel method.

Assessment committee:

Prof.dr.ir. C.H. Venner	(chairman)
Dr. ir. R. Hagmeijer	(supervisor)
Ir. J.P. Schilder	(supervisor)
Dr. ir. P.C. Roos	(external member)

Chairman,

d.d. 30/9/2016