Faculty Engineering Technology
Program Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of her MSc thesis assignment

K.M. Knepper

will give a presentation, entitled

Electromagnetic Waves in Acoustically Strained Fibers

Date: Thursday July 3, 2014

Time: 14:00

Room: **Horst Building room N.109**

Summary:

The propagation of electromagnetic (EM) waves through cylindrical waveguides has been analyzed in view of a distributed sensing application. Straining in optic fibers can be localized by the method of Rayleigh scattering. Perturbation of the fiber by a pressure field causes a change in the slope of the detected backscatter signal. This enables distributed sensing of acoustic waves by means of EM waves.

It is noted that the velocity scales involved differ enormously since the speed of light is of order $c \sim 10^8$ m/s, while the speed of sound is up to a factor of a million smaller, $a \sim 10^2 - 10^3$ m/s. This extreme difference makes that acoustic waves appear to be nonmoving compared to the propagating light waves.

It is remarkable that both types of waves in this application travel through concentric layers of different materials. Therefore it can be shown that their behavior is similar since both waves satisfy the same wave equation and thus, for cylindrical coordinates, both can be described in terms of Bessel functions.

There are several methods of measuring strain in optic fibers. Strained optic fibers experience perturbations in the refractive index. This can affect the intensity, phase and speed of light in the fiber, which all can be used to measure the pressure field.

Assessment committee: **Chairman,**

Prof.dr.ir. H.W.M. Hoeijmakers (chairman)
Dr.ir. R. Hagmeijer (mentor)
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