Faculty Engineering Technology
Program Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

R.M. van Dijk

will give a presentation, entitled:

Improvements in Prediction of Cavitation Noise from Ship Propellers

Date: Friday August 1, 2014

Time: 14:00

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

Summary:
The process of cavitation can be harmful to ship propellers and their surroundings. Bubbles shedding from a cavity create powerful pressure pulses, which generate noise and, in extreme cases, can damage the propeller and ship. The prediction of these pressure pulses is of interest to the design and production of more silent propellers.

In this study a method for noise prediction, as described by Matusiak [1992] and implemented in Matlab by van Wijngaarden [2013] has been analysed. The method uses a boundary element computation to describe sheet cavitation. The sheet cavity size is used for the purpose of determining the bubble volume shedding from the sheet cavity and uses either the Rayleigh-Plesset [1949], Gilmore [1952] or Keller-Miksis [1980] equation to describe the behaviour of the bubbles as they are convected with the flow.
The computed noise production depends on the initial conditions, as present when the bubbles form from the sheet cavity; the pressure field, through which the bubble is convected; and the model used to describe the bubble oscillations.

To find the dominant parameters a single oscillating bubble has been studied in order to determine the influence of the initial conditions, as well as the effect of the pressure field and that of the oscillation dynamics model. The Matusiak method is further evaluated for parameters unique to the method, i.e. the bubble size distribution, void fraction and the number of oscillations per bubble.

A new description of the initial gas pressure is proposed, which takes into account the surface tension. The original description, as used by Matusiak, resulted in negative pressures just outside the bubble wall for small bubbles.

A sensitivity study has shown that the single bubble is most strongly influenced by the assumption of evaporation and condensation taking place, while the parameters with the strongest influence in Matusiak's method are the number of oscillations computed per bubble, the void fraction and the assumed size distribution of the bubbles formed.
Comparison of the present results with measurements for a ship propeller show that it is possible to match the predicted spectrum to the one obtained in the measurements.

Assessment committee: **Chairman,**

Prof.dr.ir. H.W.M. Hoeijmakers (chairman)
Dr.ir. H.C.J. van Wijngaarden (mentor)
Dr.ir. R. Hagmeijer
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