

COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his MSc thesis assignment

Thomas Hommes

will give a presentation, entitled:

Development of Engineering Method to Determine Size of Cavitating Vortex Used for Prediction of Noise

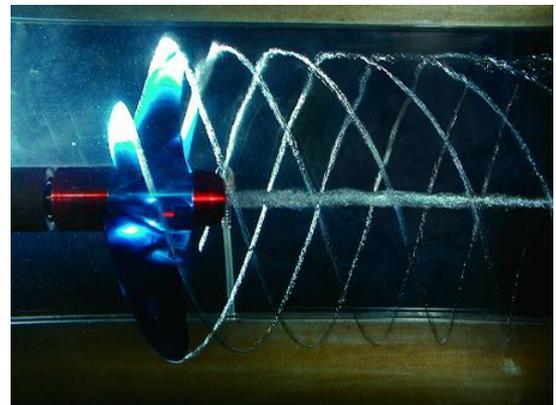
Date: Friday February 13, 2015

Time: 11:00

Room: Horst Building Room ZH-286

Summary:

For crew and passengers onboard ships cavitation on marine propellers is an important source of noise and vibrations. For ships with high comfort requirements, such as cruise ships, the amount of cavitation on the propeller is limited to a small sheet cavity and a cavitating tip vortex. The pressure fluctuations on the hull of the ship caused by the sheet cavity can be predicted with potential flow methods. However, methods that predict the pressure fluctuations due to a cavitating tip vortex are scarce.



At Marin the Empirical cavitating Tip Vortex model (ETV-model) is being developed. This is a semi-empirical method for the prediction of pressure fluctuations on ship hulls. This method strongly depends on the size of the cavitating tip vortex. In the ETV model an inviscid vortex model is used to determine the cavity radius. The results of the ETV model are promising. However, the empirical coefficients in the model differ too much for different test cases. The aim of the present study is to improve the results of the ETV model by predicting the cavity radius more accurately by using viscous vortex models.

In the present study several vortex models have been investigated and results of these models have been compared to velocity and pressure measurements in the near field of a wing tip vortex. Of these models, the Vatistas vortex model is the most promising.

Furthermore the influence is investigated of different terms in the radial momentum equation on the pressure distribution in the vortex. It is concluded that the pressure distribution obtained from the tangential velocity only gives an acceptable result, with at most fifteen percent deviation from the measured pressure distribution.

For the parameter in the Vatistas vortex model a semi-empirical relation has been developed based on the circulation of the vortex and its size of the viscous core. With this semi-empirical relation the cavity radius can be computed based on the size of the viscous core and the circulation only. The computed cavity radius is compared to several datasets of pressure and velocity distribution in wing tip vortices. For this the circulation is obtained from the a panel method for steady potential flow. The size of the viscous core is estimated semi-empirically based on literature and other datasets. It is concluded that the developed method gives better predictions for the cavity size.

Assessment committee:

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d.d. _____