Maritime DTU
Center for Maritime Activities

Propeller Cavitation Prediction using Potential Flow Simulations

Type of project: MSc

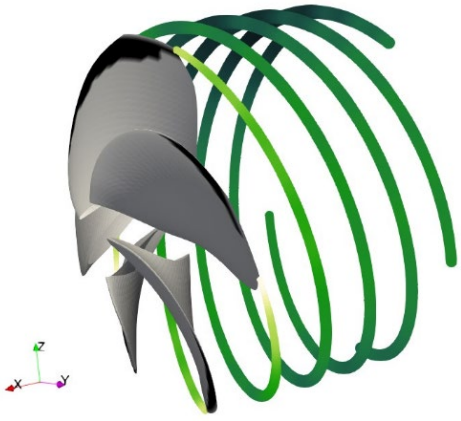
Project description:
For turbomachinery that generate low pressure field in the surrounding fluid, such as a ship propeller, the phenomenon of cavitation holds great significance. From the propeller design perspective, the prediction of its cavitation behaviour through numerical simulations is an important step. Potential flow simulations, with an inviscid flow assumption, offer significant reduction in the computational time and effort and reasonably accurate predictions of the overall propeller cavitation behaviour. One such potential flow solver specific to propeller applications is ESPPRO, which is developed at DTU. It uses the Boundary Element Method (BEM) to define hydrodynamic sources and dipoles on the propeller blade and trailing wake surfaces, in order to describe the surrounding flow field. ESPPRO includes analytical models to predict the shape and size of sheet cavities and tip vortex cavities.

In this project, the student will undertake design studies using the sheet cavitation and tip vortex cavitation models in ESPPRO. The influence of different input parameters – related to the blade geometry, environmental conditions, and calibration factors – are to be investigated. The student is expected to perform the following preparatory tasks in order to familiarize himself/herself with ESPPRO:

- Literature review on potential flow theory and its application to propeller flow
- Case study for open water and cavitating propeller simulations
- Sensitivity study – mesh sensitivity and ESPPRO simulation settings
- Validation of numerical predictions against experimental results

In addition, the student may choose to work on one of the following focus areas or add one of his/her own choice, as the project progresses:

- Improved model for blade trailing wake
- Iterative algorithm for sheet cavity shape
- Alternate vortex models for tip vortex cavitation
- Alternate model for viscous drag



Knowledge of FORTRAN, or the willingness to learn, is desirable in order to ensure direct implementation in ESPPRO. The project is expected to take around 6 months. The student may be located either at DTU or at MAN-ES, Teglholmsgade 41, København SV.

Contact persons

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