Maritime DTU
Center for Maritime Activities

Numerical Simulation of Propeller Underwater Radiated Noise

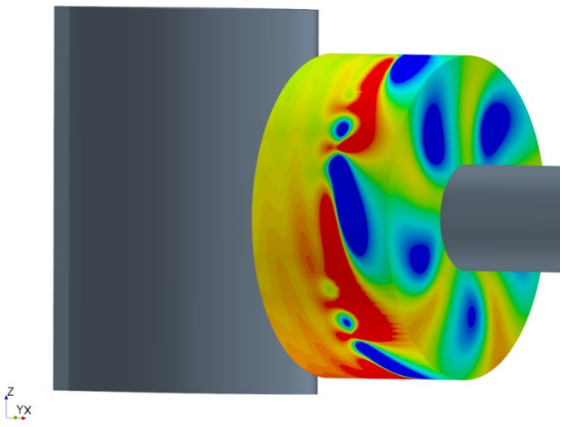
Type of project: MSc

Project description:

With growing concerns about underwater noise pollution and its adverse impact on marine life, there is increased interest in research related to underwater acoustics. Ship propellers are a major source of underwater noise, and numerical simulation of propeller hydroacoustics is an important step to understand their radiated noise characteristics. However, propeller hydroacoustic simulations are computationally intensive due to the requirement of numerically solving the compressible Navier-Stokes equations. Certain simplifications, such as the acoustic analogy concept, allows for relatively faster computations, but the specifics of its implementation for propeller hydroacoustics is still an ongoing research topic.

In this project, the student will attempt to simulate the underwater radiated noise of a ship propeller using the Ffowcs-Williams Hawkings (FWH) acoustic analogy. Various FWH implementation approaches shall be investigated such as the permeable-FWH and solid-surface FWH. Comparison of the acoustic predictions where the flow solution is obtained from a viscous flow solver to that obtained from a potential flow solver is expected. Further description of the tasks are as follows:

- Literature review
- Familiarization with software packages
- Sensitivity study – spatial and temporal discretization
- Hydroacoustic simulations with Star-CCM+ (viscous flow solver, with in-built FWH implementation)
- Hydroacoustic simulations with ESPPRO (potential flow solver) & DoLPHiN (solid-FWH implementation)
- Comparison of hydrodynamic and hydroacoustic pressure pulse decay behaviour for open water conditions, along with theoretically predicted rates
- Investigation on the size of permeable data surface
- Comparative predictions of the propeller noise spectrum



The project is expected to take around 6 months. The student may be located either at DTU Construct, Section of Fluid Mechanics, or at MAN Energy Solutions, Teglholmsgade 41, København SV.

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