Underwater broadband noise emissions from cavitating propellers

A PhD project by Leonie Föhring

✉ Leonie.foehring@fh-kiel.de
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Principal supervisor: Peter Møller Juhl
University of Southern Denmark, Odense
Co-supervisor: Berend Bohlmann
Kiel University of Applied Sciences

Background

Human-induced underwater noise affects the marine fauna worldwide. Propellers are one of the main sources for underwater noise emitted by ships. Of these, cavitating propellers are the dominating means of propulsion used on cargo and passenger ships and contribute significantly to the underwater noise in all oceans and particularly along the worldwide shipping routes and in areas with dense ship traffic, e.g. the Baltic Sea. Their noise spectra show concordantly a yet unexplained characteristic of broadband noise with a maximum at approximately 50Hz, independent from ship type, propeller design details, the number of blades or the speed of rotation [1, 2].

It is expected that sheet cavitation dominates the high levels of the emitted noise. However, the dominating way of noise generation has yet to be identified to understand the noise generating mechanism. This will allow ship designers, ship operators and regulatory authorities to design, operate and supervise quieter ships in compliance with future regulations to the benefit of the underwater fauna.

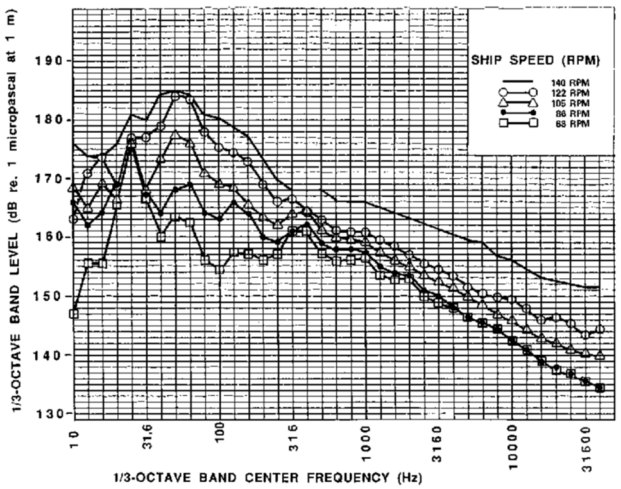

Figure 1: Noise spectrum of a bulk carrier [1]

Objectives and methods

The overall objective of this PhD project is to analyse the noise generating mechanism, which is responsible for low-frequency broadband noise emitted by cavitating propellers.

The main focus lies on the influence of sheet cavitation. The project will be conducted at Kiel UAS and consists of the following methods:

- research regarding the state of art related to sheet cavitation and its radiated noise as well as regarding characteristics of measured noise spectra emitted by ships
- advanced numerical analyses (e.g. Computational Fluid Dynamics, Finite and/or Boundary Element Method) in order to investigate the behaviour of sheet cavitation and its influencing parameters
- cavitation tunnel experiments in order to verify the identified parameters for example by means of acoustical measurements and visual observation of the development of sheet cavitation

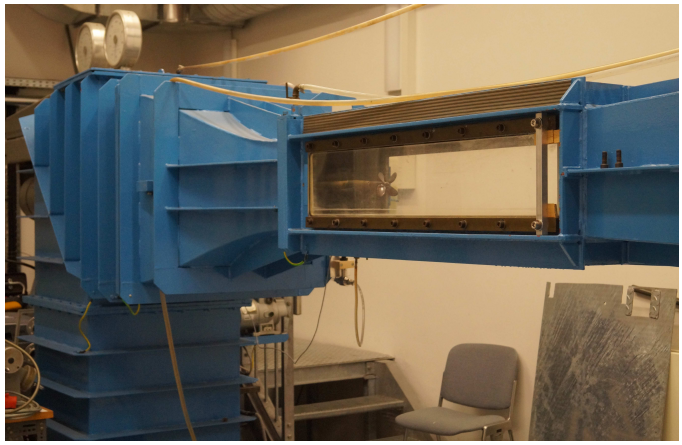

Figure 2: Cavitation tunnel at Kiel University of Applied Sciences

References

[1] Arveson, Paul T.; Vendittis, David J. (1999): Radiated noise characteristics of a modern cargo ship. In: The Journal of the Acoustical Society of America 107 (1)

[2] Hallett, Mark A. (2004): Characteristics of merchant ship acoustic signatures during port entry/exit. In: Proceeding of ACOUSTICS

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