

# Underwater noise analysis of operating offshore wind turbines

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## Summary

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*Offshore wind farms radiate underwater sound into the marine environment. Marine life can perceive and be disturbed by underwater anthropogenic noise and water particle vibration. To understand the impact of wind turbine noises on marine life the sound pressure as well as the particle motion field should be measured and analyzed. Establishing the relationship between these two fields is the key question to predict particle motion values of the various sources of anthropogenic noise. This study is carried out jointly with marine biologists from the University of Tartu.*

Research field:	Environmental, marine and coastal technology
Supervisor:	Prof. Dr. Aleksander Klauson
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

## Description

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The demand for renewable energy has led to the construction of offshore wind farms with high-capacity turbines. The increasing capacity of wind turbines has raised concerns about their impact on the marine environment. Marine life often uses sound for feeding, communicating and orientation, and can therefore be adversely affected by anthropogenic noise during the construction and operation phases of large offshore wind turbines. Marine mammals rely heavily on underwater sound to communicate and are therefore more sensitive to underwater sound pressure. Fish depend mainly on the movement of water particles to detect prey or predators. The study of underwater particle motion is a relatively new field of research that offers the potential to contribute to improving the ecological state of the ocean. The goal of this Ph.D. project is to predict particle motion values of anthropogenic noise sources to help assess the environmental impact of offshore wind farms.

The thesis should address the following research questions:

- 1) How to model particle velocity field of an offshore wind turbine?
- 2) What is the relationship between underwater sound pressure and particle motion velocity in the shallow sea?
- 3) What are the allowable particle velocity values to prevent wind turbines from having a negative impact on the environment?

### *Responsibilities and (foreseen) tasks*

- Participation in sea trials to help set up the underwater measurement equipment.
- Collect data on the underwater recordings of the functioning offshore wind turbines worldwide.
- Contribute to signal processing of the sound and particle velocity signals.
- Contribute to data analysis and development of a sound propagation model.
- Contribute to the organization of research workshops and seminars.

### *Applicants should fulfill the following requirements:*

- a master's degree in physics or engineering sciences (preferably technical physics);
- basic knowledge in the fields of Mechanical Vibration and Acoustics.
- programming skills in R, Python, MATLAB.
- a clear interest in the topic of the position.
- excellent command of English.
- strong and demonstrable writing and analytical skills.
- capacity to work both as an independent researcher and as part of an international team.
- capacity and willingness to help in organizational tasks relevant to the project.

*The following experience is beneficial:*

- Working knowledge of statistics

*We offer:*

- 4-year Ph.D. position in the largest engineering research center in Estonia,
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the field of engineering.

*About the department*

The Department of Civil Engineering and Architecture is an interdisciplinary teaching and research center at Tallinn University of Technology, which focuses on various actual research issues. Mechanics of Fluids and Structures Research Group is working on various mechanical problems, one of which is Acoustics. Lab of Acoustics was created in 2010. Main research topics since that time were:

- sound propagation in plates and shells,
- non-destructive ultrasound evaluation,
- sound propagation in composites,
- ocean acoustics.

Research in ocean acoustics is mainly focused on ambient underwater sound monitoring in relation to nature protection and environmental assessment. The aim of these studies is to ensure that anthropogenic noise do not adversely affect marine life.

*(Additional information)*

For further information, please contact Prof Aleksander Klauson [aleksander.klauson@taltech.ee](mailto:aleksander.klauson@taltech.ee) or visit <https://taltech.ee/en/laboratory-underwater-acoustics>



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