

# Particle Motion in the Underwater Acoustic field of an Offshore Wind Turbine

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## Summary

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*Offshore wind farms emit underwater sound into the marine environment. Marine life can perceive and be disturbed by the underwater anthropogenic noise water particle vibration. To understanding the impact of wind turbine noises on migratory Baltic herring the sound pressure field as well as the particle motion field of the wind generator should be measured and analyzed. Establishing 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 in cooperation with marine biologists from 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 October 01, 2022 00:00 and October 23, 2022 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-power turbines. The power of the wind turbines is getting higher, and this has raised concerns about their impact on the marine environment. Marine biota is often use sound for foraging, and communication and orientation and may therefore be adversely affected by man-made noise generated during the construction and operation of large offshore wind turbines. Marine mammals are mostly using underwater sound and therefore more susceptible to underwater sound pressure. Fish mainly rely on the water particle motion to detect prey or predators. Underwater acoustics as a science has been developing for more than a century while underwater particle motion research is quite new research field.

The goal of this PhD project is to is to predict particle motion values of the sources of anthropogenic noise to help environmental impact assessment of offshore wind farms.

The thesis should address the following questions: 1) How to simulate underwater sound pressure and particle motion field of the offshore wind turbine? 2) What is the relationship between underwater sound pressure and particle motion velocity in shallow sea? 3) What are the allowable particle motion velocity values to avoid adverse effect of wind turbine to the environment?

## Responsibilities and (foreseen) tasks:

- Participation in sea trial to help setting up of 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 sound propagation model
- Contribute to the organization of research workshops and seminars

## Applicants should fulfil the following requirements:

- a master's degree in physics or engineering sciences (preferably technical physics)
- 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:**

- Basic knowledge in the field of Vibration and Acoustics
- Programming in R, Python, MATLAB
- Working knowledge of statistics
- Diving skills are beneficial to enjoy underwater world of the Baltic Sea

**We offer:**

- 4-year PhD 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**

Department of Civil Engineering and Architecture is an interdisciplinary teaching and research center of Tallinn University of Technology that focuses on various actual research issues. Mechanics of Fluids and Structures Research Group is working on various mechanics 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,
- underwater acoustics.

Experimental research in ocean acoustics is mainly focused on ambient underwater sound monitoring in relation to European Marine Strategy Framework Directive (MSFD). This activity started in 2012 with the LIFE+ BIAS project (Baltic Sea Information on Acoustic Soundscape). According to MSFD each member state should take care of their marine EEZ to ensure that it is in good environmental status (GES). One of the descriptors of GES needs that anthropogenic sound emitted in water will not adversely affect marine populations. TalTech research group on acoustics is involved in the development of methodology of the GES assessment and threshold values on the European level (EU Technical Group TG-Noise) as well as on the level of the Baltic Sea (HELCOM EN-Noise expert group). Assessment of the environmental state of the Baltic sea is currently developed in frames of BALTIC BLUES project where TalTech is leading in the anthropogenic underwater noise impact assessment.

**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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