# Ocean Wave Interaction with Wind Turbine Foundations

**Type of project:**
MSc

**Project description:**
This project considers accurate real-time simulations of ocean waves around offshore wind turbine foundations and real-time calculations of ocean wave forces on service vessels.

Proper simulation training is an important tool used to reduce the risks of accidents for navigators and service crews during service operations in offshore wind farms. Moreover, the simulations can be applied in the design process to test new vessel designs and ensure safe manoeuvres and personnel transfer to be conducted within given weather windows. The quality of such simulations of course highly relies on the physical realism. For a service vessel manoeuvring in the vicinity of an offshore wind turbine and maintaining a controlled contact with the boat landing, veracity depends on accurate calculation of forces and moments from the ocean waves.

**Suggested approach**
From an incoming irregular wave field with directional spreading, calculate the scattered wave field using a commercial radiation/diffraction code such as WAMIT or OMEGA. For a time-domain visualization of the wave field, the wave elevation is evaluated in real-time (~20 Hz) on a grid that covers a relatively large area surrounding the wind turbine. Time-domain forces and moments on the service vessel are calculated from evaluation of the wave elevation and surface potential grid covering a smaller area around the vessel. The pressure on the hull is calculated from linear wave theory and integrated over the hull to calculate the forces and moments.

The tools use in the project will mainly be WAMIT and MATLAB. The student will extend an existing linear water wave MATLAB code with a proof of concept solution for the real-time wave elevation and forces on the vessel. When the solution method is fully developed in MATLAB, it may later be integrated into the FORCE Technology simulator SimFlex4 and with the wave solution calculated by OMEGA, if time permits.

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