**Master Thesis Project – Modelling of wave loads on large wind turbine monopile foundations**

**Overall project description**

Monopile foundations are the most popular foundation concept for offshore wind farms, and wave loading is one of the most important design drivers for monopile foundations. Therefore, to obtain cost effective monopile designs and industry accepted models for estimation of wave loads, like the linear wave theory and Morrison Equation with MacCamy-Fuchs, corrections must be proved accurate through validation.

DONG Energy has measured wave loading on several monopile foundations before installation of the wind turbine. This data is valuable for validation of wave load models, since the wave loads are the dominant source of structural loading, besides the wind turbine. Standard wave load models can be compared to this data set to validate and/or propose improvements to the models.

**Detailed project description**

You will be provided with one or more monopile load measurement data sets. Each load data set will be accompanied by wave measurement data from a nearby wave buoy. You must implement a numerical wave load model like eg. MATLAB and determine how accurately the measured loading can be reproduced.

The project is expected to cover the following content

* develop an understanding of and perform necessary pre-processing of load and wave measurement data
* apply and understand industry standard wave load models:
  + wave kinematics predicted by linear wave theory with wheeler stretching and MacCamy-Fuchs correction using wave data
  + wave loading estimation using Morrison Equation and structural geometry to determine hydrodynamic coefficients
* compare load measurements to wave load predictions
* determine situations for which the wave model performs well or poorly
* implement improved wave load model(s),eg using non-linear wave theory, to determine if the wave load predictions can be improved.

**Category**Hydrodynamics, wave modelling, offshore structures, wind energy.

**Type**

Theoretical study, based on provided data sets.

**Requirements**

Student within mechanical engineering, civil engineering or similar.

**Desired start date**

Fall 2016 or winter 2017.

**Number of students**

One or two students.

**Academic level**

Master’s level.

**Project Supervisors/ Departments**

Cameron Brown, Load Measurements and Verification

Niels Jacob Tarp-Johansen, Loads Aerodynamics & Controls

Suggested academic supervisor: Henrik Bredmose, DTU Wind Energy

**Contact us**Please do not hesitate to contact [windthesis@dongenergy.dk](mailto:windthesis@dongenergy.dk) if you have any further questions.