MOCEAN OFFSHORE BV

Graduation project

The construction of offshore wind farms require many, costly installations in sometimes challenging conditions. Examples are the lifting and transportation of bottom founded structures and the Wind Turbine Generators steel structures that are mounted on top of them. Also the installation of the export cables, that connect the wind farm to shore, and the installation of several connecting array cables are expensive and involve typically high CAPEX components.

The installations are performed in calm or mild weather conditions at a safe and, at the same time, in an efficient manner. Therefore it is important to have good predictions on the weather, and good insight in the workability of the installation vessel at all times. The workability tells what the maximum environmental condition are, like wind waves, swell and current, at which the installation can still be performed safely according to specified criteria on allowable motions and accelerations.

Due to the particular hydrodynamic properties of the vessel, (e.g. RAOs), the environmental conditions (wind waves, swell, bathymetry) the mass and shape of the lifted load or the installed cable, each operation requires a specific workability assessment. Other parameters that can influence the workability are the cable installation method and mechanism, the mechanical properties of the cable and the water depth.

Mocean-Offshore wants to develop the Mocean Capability Tool that generates workability plots for different types of offshore operations. It will be a generic tool that can be applied for different ships (e.g Very Heavy Lifting vessels, cable lay vessels), different lifting and cable lay operations. The tool should have the possibility to get real time feedback from motion sensors installed on a vessel. The sensor signals can be used for passive and active feedback. With active feedback, the workability model parameters are updated with the actual vessel's response. At the heart of the Mocean Capability Tool, there will be an time-domain ODE solver that computes the differential equations for motions of offshore installation vessel for a wide variety of operational and environmental conditions. This includes wave, vessel, mooring and line dynamics for the flixibles.

The thesis student (Mathematics) should focus at:

- Defining an algorithm that can efficiently solve the large sets of equations of motion.
- The algorithm should be able to optimize it's own performance
- The equation of motion (a 2^{nd} order diff. eq.) will be solved for the 6 Degrees of freedom of the vessel as well as for the catenary and FEM-like elements of the cable. The cable may be approached using standard string & beam theories for mechanics.

The student should have an aptitude for solving complex problems and working with physics related mathematics in a numerical environment.

The MSc student will work closely with Mocean-Offshore staff that consist of experts working with advanced software tools applied in offshore technology. More information about Mocean-Offshore can be found at www.mocean-offshore.com.

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