Postdoctoral job opportunity on the developments of new modelling features in open source hydrodynamic potential codes NEMOH and HOS-Ocean.

Location: LHEEA Lab at Centrale Nantes (France)

Contract duration: 24 months

Expected starting date: 4th of January 2021

Recommended skills: programming proficiency, PhD thesis on potential flow theory, English language proficiency.

Contact details: Interested candidates should submit a cover letter of interest, curriculum vitae to jean-christophe.gilloteaux@ec-nantes.fr and guillaume.ducrozet@ec-nantes.fr

Context

Centrale Nantes has a new postdoctoral position available within the framework of the EU-funded FLOATECH project. FLOATECH aims at increasing the technical maturity and the cost competitiveness of floating offshore wind energy. Among the different objectives of the project, a fully-coupled, aero-hydro-servo-elastic design and simulation environment (named QBlade-Ocean) will be developed.

Within this project, Centrale Nantes is seeking a person to work on the implementation of the hydrodynamic module of this new simulation tool. This work will encompass implementations of new modelling features in the open source code NEMOH as well as its integration, along with the one of the open source code HOS-Ocean, in QBlade-Ocean.

NEMOH is a Boundary Element Methods (BEM) code dedicated to the computation of first order wave loads on offshore structures (added mass, radiation damping, diffraction forces). It has been developed by researchers at Ecole Centrale de Nantes for 30 years. Typical use is estimation of dynamic response of floating structures or performance assessment of wave energy converters.

HOS-Ocean is a numerical model dedicated to the propagation of non-linear wave fields in open ocean with arbitrary constant depth. It is based on the High-Order Spectral (HOS) method, which enables the simulation of highly non-linear wave fields. It has been developed at Ecole Centrale de Nantes for 10 years.

Both models are already at use in several research projects.

Work description

The main goal of this work is the coupling of the hydrodynamic solvers NEMOH and HOS-Ocean with the aero-servo-elastic model of QBlade-Ocean. The work is split into three tasks:

- Coupling of the linear potential solver NEMOH with structural solver.

QBlade-Ocean will permit the user to treat the floating platform as a flexible structure. Accounting for floater structural deflection requires the pressure impulse response functions to be calculated in the NEMOH pre-processor. To enable this modelling feature, new developments shall be implemented into NEMOH.

- Second-order hydrodynamic loads in NEMOH

In this task, the calculation of the quadratic transfer function formulation (QTF) shall be incorporated into NEMOH. The QTF allows for the treatment of second-order hydrodynamic loads due to both platform motion and incoming waves. The development shall occur within the NEMOH environment and through the coupling to QBlade-Ocean.

- Higher order wave interaction forces

This task is dedicated to the integration of the open-source code HOS-Ocean into QBlade-Ocean. The HOS-ocean nonlinear wave solver together with its post-processing library Grid2Grid describes in an accurate and efficient way the wave kinematics. The successful integration to QBlade-Ocean will permit the treatment of higher order wave loads.

Objectives

- Developments to enable the computation of pressure impulse response functions with NEMOH,
- Developments to enable the computation of Quadratic transfer Functions with NEMOH,
- Integration of HOS-Ocean into QBlade-Ocean.

Expected Results

- Full integration of NEMOH in QBlade-Ocean framework,
- Complete integration of HOS-Ocean in QBlade-Ocean framework.
- Diffusion of the results in international conferences and top-ranked journals