MSc. Thesis Proposal

Title: Hydrodynamic Analysis of a Floating Offshore Wind Turbine: Damping

Supervisors

Professor at IST
António Maximiano (Eng): Renewables and CFD Researcher at blueOASIS
Guilherme Vaz (Dr., inv. Prof): R&D manager at blueOASIS

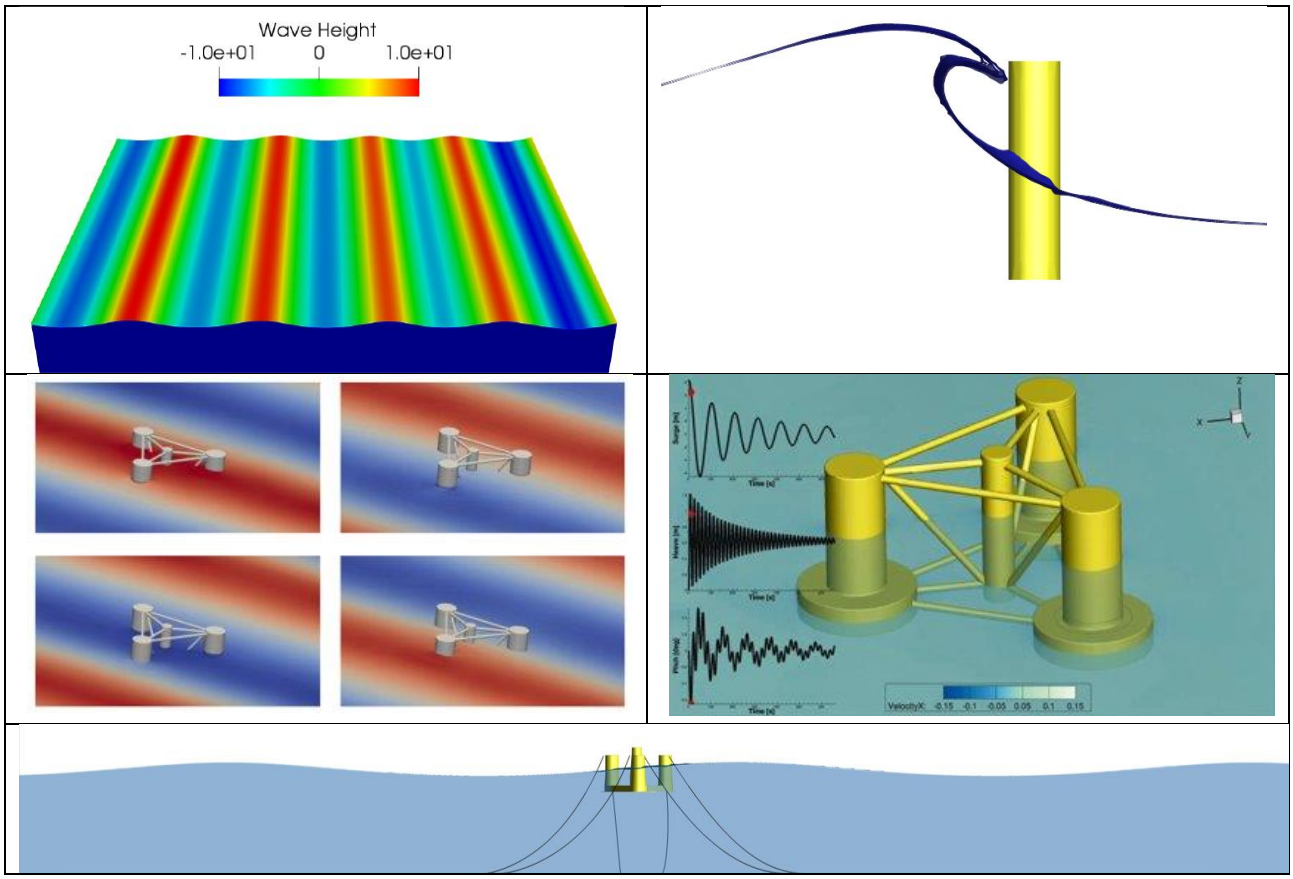
Introduction

Motivation

The correct modeling of the hydrodynamic response in ocean waves is of interest for many practical applications, such as for floating offshore wind turbines. These are highly complex systems, with non-linear interactions between the hydrodynamic, mooring, structural, aerodynamic, and control systems. The lack of understanding of these interactions and the complexity of the simulation models needed to predict them leads to an overconservative design of these systems. In order to safely reduce the safety margins, thus reducing the costs and improving the competitiveness of the floating offshore wind technology, a better understanding of this problem is necessary.

Existing work

Several steps have been taken towards improved simulations of these complex systems using CFD solver ReFRESCO: verification and validation of a 2D wave propagation in deep water out (Lima, 2021); CFD verification of breaking waves; estimation of hydrodynamic damping (Burmester et al., 2020); response in waves (Wang et al., 2022);aerodynamic analysis of the turbine (Gomes, 2021);



Objectives

1. Obtain the hydrodynamic coefficients of a floating offshore wind platform using a forced oscillation setup:
    a. Obtain the viscous damping coefficients for different amplitude and period combinations
    b. Obtain the added mass coefficients for different amplitude and period combinations
    c. Carry out a verification study to quantify the numerical uncertainty of the estimated parameters

Requisites

Applicants must have:

- General knowledge on CFD.
- Coding experience with python or similar.

Good to have:

- Linux experience.
- Latex experience.
- Git experience.

Added value to have:

- Knowledge on uncertainty quantification.

Location

blueOASIS (www.blueoasis.pt) offices at Oeiras or Ericeira
Edificio D.Pedro, Quinta da Fonte, R. Malhões, 2770-071 Lisboa
R. Prudêncio Franco da Trindade 4, 2655-344 Ericeira

The student is invited to join the team in the office when the supervisor is present (at least three days per week).

Companies Involved

blueOASIS is a young team with more than 45 years of combined knowledge and experience on Aerospace, Mechanical, Naval and Maritime engineering. The multicultural and multidisciplinary team is committed to make our oceans safer and greener, using state of the art numerical and data science tools. BlueOASIS focuses on renewable energies, ocean cleaning, decarbonization, sustainable offshore structures and green ships optimization.

References:

Burmester, S., Vaz, G., el Moctar, O., Gueydon, S., Koop, A., Wang, Y., & Chen, H. (2020). High-fidelity modelling of floating offshore wind turbine platforms. *Proceedings of the International Conference on Offshore Mechanics and Arctic Engineering - OMAE*, *9*, 1–12. https://doi.org/10.1115/omae2020-18913

Gomes, T. (2021). *Verification Study of Sliding and Overset Grid Methods - An Application to Wind Turbine CFD Simulations*. *1*(November). https://fenix.tecnico.ulisboa.pt/cursos/meaer/dissertacao/1691203502344595

Lima, E. (2021). *Verification of a 2D Wave Model* [Master Thesis, Instituto Superior Técnico]. https://fenix.tecnico.ulisboa.pt/downloadFile/1689244997263095/Thesis78787.pdf

Wang, Y., Chen, H. C., Koop, A., & Vaz, G. (2022). Hydrodynamic response of a FOWT semi-submersible under regular waves using CFD: Verification and validation. *Ocean Engineering*, *258*, 111742. https://doi.org/10.1016/J.OCEANENG.2022.111742