Proceedings of EWTEC 2021

The 14th European Wave and Tidal Energy Conference was held from 5-9 September 2021 at the University of Plymouth. For the first time, in response to the global pandemic, EWTEC was held in a hybrid format, allowing attendees to present online as well as in person. There were 12 different thematic tracks:

- Wave resource characterization
- Wave hydrodynamic modelling
- Wave device development and testing
- Tidal resource characterization
- Tidal hydrodynamic modelling
- Tidal device development and testing
- Structural mechanics: materials, fatigue, loadings
- Station-keeping, moorings and foundations
- Operations and maintenance
- Grid integration, power take-off and control
- Environmental impact and appraisal
- Economical, social, legal and political aspects of ocean energy

From the 403 abstracts initially submitted, 236 full papers were finally selected by a peer-review process, during which 48 Track Directors requested 963 single blind reviews and 427 reviews were finally carried out. These papers comprise the present proceedings, totalling 1952 pages.

This USB flash drive contains the searchable conference proceedings.

On behalf of the EWTEC Committee, I would like once again to warmly thank all the reviewers and Track Directors for their essential and voluntary work, and all authors for their contribution to the scientific content of the 14th EWTEC.

I would also like to sincerely thank our Sponsors for their valuable support to the conference.

Professor Deborah Greaves

Chair of EWTEC 2021

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Compiled by Dr. Luke Blunden (Energy and Climate Change Division at the University of Southampton)

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Numerical simulations of a Floating Offshore Wind Turbine Substructure

L. Galera-Calero, J.M. Blanco, R. Ocampo, U. Izquierdo and G. Iglesias

Abstract— **The combination of wave and aerodynamic loads acting on Floating Offshore Wind Turbines (FOWT) creates a complex system that must be studied in detail to harness as much energy possible while maintaining structural integrity. Computational fluid dynamics (CFD) is a useful analysis tool, which enables to consider the key parameters (e.g., mooring line forces, wave characteristics, aerodynamic loads) and, thus, help in the design process. However, its computational cost is often prohibitive. For this reason, simplifications must typically be introduced. In this paper, simulations of heave decay tests, with and without moorings, under regular waves were compared with experimental data obtained from previous studies carried out by Saitec Offshore Technologies in the MaREI Centre (Ireland). Future research will focus on the dynamic viscosity behaviour.**

Keywords—**CFD, Decay testing, Floating offshore wind turbines, Mooring line loads, Regular wave trains.**

I. Introduction

Floating wind technology has emerged in the last few years as one of the most promising alternatives to maintain the growth of the renewable energy share in the primary energy mix of the whole world [1].

Despite its noticeable cost, mainly the higher costs of installation and maintenance [2], applicable to all offshore wind turbines when comparing them to onshore devices, the idea of floating wind unlocks the possibility of going further from the coast and harnessing greater wind speeds and of better quality [3]. Besides, areas with water depths below 50 m, where fixed offshore wind technology may be used, do not abound [4]. Consequently, the countries with the most offshore wind energy capacity installed at present, such as the UK or Denmark, are those with large sea areas with small depths (< 50 m) [4].

However, the combination of hydrodynamic and aerodynamic loads in floating systems creates a complex behaviour that must be studied in detail. This is essential to harness as much energy as possible while maintaining their structural integrity [5]. Therefore, a problem appears due to the number of analysis and the time of tests needed to install a system of this type. In this scenario, computational simulations are a fundamental tool, along with the improvements in the hardware. Different tools, such FAST, developed by the National Renewable Energy Laboratory (NREL) [6], are used both in academia and industry. However, these types of tools, based mainly on potential flow theory, diverge from the ground truth when taking into consideration non-linear loads [7]. Due to this, computational fluid dynamics (CFD) based in Reynolds-averaged Navier-Stokes equations, allows to have a better definition of the response and behaviour of the system when considering the different forces that affect it, such as the mooring line forces, the hydrodynamic, and the aerodynamic loads. Besides, this approach gives a better information of the flow field [8]. Although the research in floating wind with RANS-based CFD is not as extended as with other tools, due to their high computational cost [9], several studies have been carried out with it.

This paper is an original submission to EWTEC 2021, under the conference track "Wave device development and testing".

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of extinction of the decay tests with moorings supports this idea.

However, considering the important differences in relative error in the decay tests, and improvement in the dynamic viscosity must be addressed for future studies.

The regular wave test reinforces this idea showing much bigger amplitudes in the response of the computational domain than in the experimental test. This difference is of a great importance because bigger response when facing waves can be causally related with a poorer power output, something that is basic when talking about Floating offshore wind farms.

Future research will focus on the dynamic viscosity behaviour and the fluid behaviour around the floating substructure. Besides, coupled simulations of unsteady aerodynamics and waves, considering catenary forces will be addressed.

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