Design of W2P Platform and Numerical Tools Used within FibreGy.

Pablo Ropero*[†], Joel Jurado Granados[¥], Javier Fernández[†], Aziza Al Mazuzi[†], Daniel Sá[¥], Borja Serván-Camas[±], Miguel Calpe[±], Andrés Pastor[±], Francesc Turón[±], Xavier Martínez[±], Fermin Otero[±].

[†]Enerocean S.L., Málaga, Spain.
E-mail: pablo.ropero@enerocean.com

[¥] Compass Ingeniería y Sistemas, S.A. (COMPASSIS), C/Gran Capità, s/n, Building B0, Campus Nord UPC, 08034 Barcelona, Spain.
E-mail: joel.jurado@compassis.com

[±]International Center for Numerical Methods in Engineering (CIMNE)
Universidad Politécnica de Cataluña,
Campus Nord UPC, 08034 Barcelona, Spain

ABSTRACT

The purpose of this work is showing some of the results obtained within FibreGy [1] research project, whose main goal is to enable the extensive use of FRP materials in the structure of the next generation of Large Offshore Wind and Tidal Power platforms. More specifically, the design process of a floating wind turbine (FOWT) is shown, as well as the numerical techniques used.

The W2Power is a patented semi-submergible platform concept developed by ENEROCEAN. It enables higher power per point of connection thanks to two wind turbines on a single floating platform that is able to weather-vane, maximizing the energy harvested. Its conceptual design has already received an "Approval in Principle" by BV and a 1/6 prototype was deployed in 2019 at the Canary Islands, making W2Power one of the most advanced FOWT designs.

To achieve an optimized and reliable design, the different physics that govern the dynamics of the device need to be modelled accurately and simulated in a reasonable time for a large number of load cases. Therefore, advanced numerical techniques are a key tool in the design of FOWT.

Within FibreGy, different numerical strategies have been developed to overcome such challenges. The first one is a Reduced Order Model to account the hydroelastic performance of the structure, by reducing the number of free degrees to be computed. The second strategy is a Fatigue Damage Assessment applied to composite laminates, based on a previous work [2]. The third numerical technique is a multi-scale model for taking into account structural details in the device (e.g. changes in thickness, reinforcements, connections), which solves the stiffness matrix of the micro model, and then it is exported to the global model. All these developments have been implemented on the commercial software Tdyn-RamSeries [3] developed by COMPASSIS, as well as they are available in its graphical user interface for being used.

Finally, the capabilities of such advanced numerical tools implemented in Tdyn-RamSeries are shown, applied to the design of the W2P platform.

REFERENCES

[1] European Union's Horizon 2020 research and innovation programme under grant agreement nº 723360 "Engineering, production and life-cycle management for the complete construction of large-length FIBRE-based SHIPs". http://www.fibreship.eu/about

[2] J. J. Granados, X. Martinez, L.G. Barbu, D. Di Capua. Fatigue prediction of composite materials, based on serial/parallel mixing theory. Composite Structures, 291 (2022), 115516.

[3] https://www.compassis.com/software/