Methodology for the design review of composite parts of floating offshore platforms

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ABSTRACT

The use of floating offshore platforms for renewable energy is still in its early stages, but the potential to generate significant amounts of clean and sustainable energy is clear. This could play an important role in helping to meet the world's growing energy demand and satisfy the need to reduce carbon emissions. Fibre reinforced composites are more and more used in this context. The specific properties of composites and their resistance to corrosion are of main interest for these applications. In order to promote the fibre reinforced plastics for marine energy converters, Fibregy project addresses the design and manufacturing aspects of two Renewable Energy Offshore Platforms: a tidal power turbine and a floating offshore twin-wind turbine. In order to assess the structural integrity of such innovative structure, a calculation methodology using in-house Bureau Veritas (BV) software suite has been developped for both extreme and fatigue loads.
The floating structure hydrodynamic response is calculated using Hydrostar. The Hydro-Aero-Mooring coupled dynamic behavior is calculated using OPERA, a new tool developped by BV. Using representative environmental conditions, OPERA runs time domain simulations post-processed to obtain loading conditions to be applied to the structure. The structural behavior is then calculated using a finite element model made of multilayer shell elements. Based on the BV Rules NR546 [1] and ComposeIT tool, composite mechanical caracteristics for each ply are determined and assigned to the finite element model. Finally, in order to assess the design for the extreme load cases, maximum stress and Hoffman criteria are considered based on rules from NR546 [1]. In the case of fatigue calculations, the BV new methodology for fatigue is applied [2]. This fatigue methodology relies on SN curves obtained at different ratio and linear interpolation in a Contant Fatigue Life (CFL diagram). The whole process, analyzed and discussed at each step, is used in order to validate demonstrators developed within the Fibregy Project.

REFERENCES

[1] ‘BV - NR546 - Hull in Composite Materials and Plywood, Material Approval, Design Principles, Construction and Survey’. Nov. 2022.

[2] J.-C. Petiteau and S. Paboeuf, ‘Fatigue assessment of composites parts for marine renewable energy converters’, in *Proceedings of PRADS2022*, Dubrovnik, Croatia, Oct. 2022.