Numerical hydrodynamic design validation and highlights of the SATH floating offshore wind turbine

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ABSTRACT

Floating offshore wind turbines (FOWT) are growing in popularity and are expected to produce an important portion of the total energy consumed soon. This fast-evolving industry has been influenced by different sectors such as oil and gas, naval, onshore wind and, primarily, by fixed offshore technology.

Saitec Offshore Technologies embraced the existing knowledge of these fields and merged them towards a highly competitive and versatile floating offshore wind turbine solution, namely SATH (Swinging Around Twin Hull) technology. The development of the technology has enabled the consolidation of deep know-how on the design methodology and engineering of such a device demonstrated through the deployment of the 2MW DemoSATH prototype.

Throughout the extensive experience of the team, a widely known problem which is the heave resonant response of the structure has been investigated. This may increase the system downtime or damage the components and acts as an important challenge which needs to be addressed. For this purpose, a possible solution is the inclusion of a heave plate [1], adopted in the SATH technology [2], which adds motion dampening mainly by viscous effects and other benefits for pitch and roll motions. This is not a common practice for oil rigs or the naval industry and, consequently, the engineering software typically employed needs to be revisited. In this scope, this work presents the calibration of different potential flow software using the Boundary Element Method (BEM) to include this phenomenon using damping coefficients and the results are successfully validated against experimental data.

A ground-breaking aspect of the SATH technology is the Single Point Mooring (SPM) system, which allows the repositioning of the platform to head towards waves or wind. This aspect introduces an additional rotating axis which should be addressed when using dynamic coupling software, where the structure response is included together with the mooring system. This work presents the validation of a numerical model to address this challenge with promising results.

More complex phenomena such as slamming [3] are being explored numerically through an open-source computation fluid dynamics software, OpenFOAM, and the results are expected to be part of the perspective for this work.

REFERENCES

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