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# Methodology for the Integration of Experimental and Numerical Fluid Dynamics in the Study of a Floating Wind Turbine Subjected to Environmental Loads

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## Résumé

The decrease in the computational cost of high-fidelity solvers like Computational Fluid dynamics (CFD) has expanded its use in the design of marine structures. This is true among academics and industrial R&D departments. After a long debate about whether CFD would or not supplant traditional experimental methods, it is widely accepted that the two approaches need to be considered together. This presentation proposes a framework for the integration of both experiments and high-fidelity numerical simulations in the design procedures of offshore wind turbines. It makes use of the nonlinear potential flow software HOS-NWT for wave generation, together with the NREL OpenFast software for wind generation and calculation of aerodynamic loads acting on the structure. For the numerical simulation, the environment (wave field) and aerodynamic loads are fed into the high-fidelity software with adequate couplings in the resolution algorithm. For the experiments, the wavemaker motion is run based on the HOS-NWT result, and the aerodynamic loads are imposed thanks to an actuator controlled by software in the loop system. This strategy and the integration of OpenFAST also allows the use of different controllers for the wind turbine. Different scenarios are considered, from the classical CFD validation with experimental results up to more complex situations where the numerics and the experiments are done in sequence one before the other or vice versa, in order to complement or verify the findings.

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