Numerical Study on the Motions of the VertiWind Floating Offshore Wind Turbine

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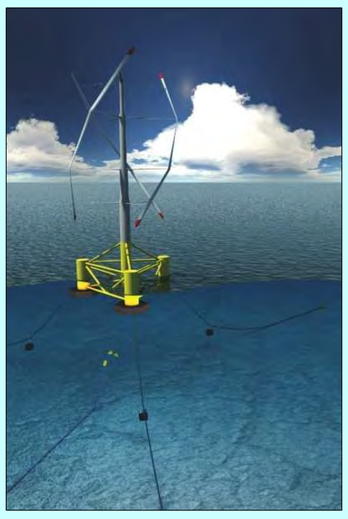
Project VertiWind

A floating offshore wind demonstrator project. One 2 MW rated unit is to be installed off Côte d'Azur, in France.



Technology developers

Nénuphar: Vertical Axis Wind Turbine design.
Technip: Floater, mooring, and installation design.

Project partners

EDF EN, Seal Engineering, Bureau Veritas, Oceanide, IFP EN, Arts & Métiers, USTV.

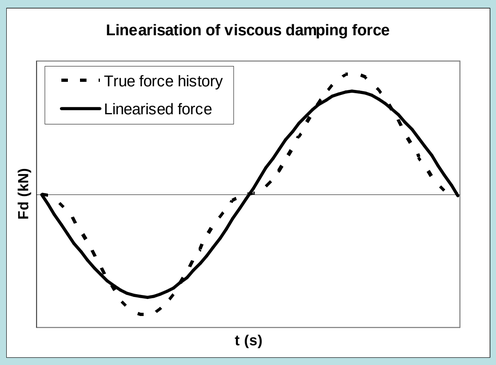
Governmental funding

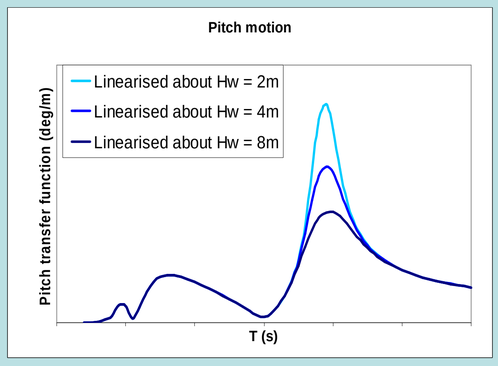
ADEME - Agence De l'Environnement et de la Maîtrise de l'Energie.

Pseudo-quadratic viscous damping

Express the viscous damping coefficient as a linear function of motion amplitude. Iterative implementation.

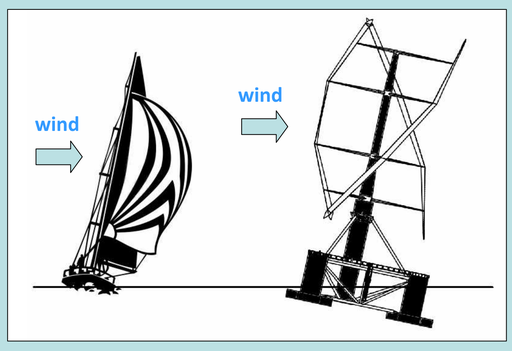
A nonlinearity is introduced in the linear Equations of Motion. Dynamic response is hence linearised about each solution.



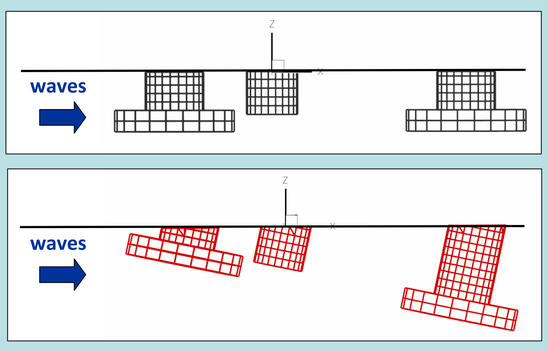


Dynamic response analysis with wind-induced trim

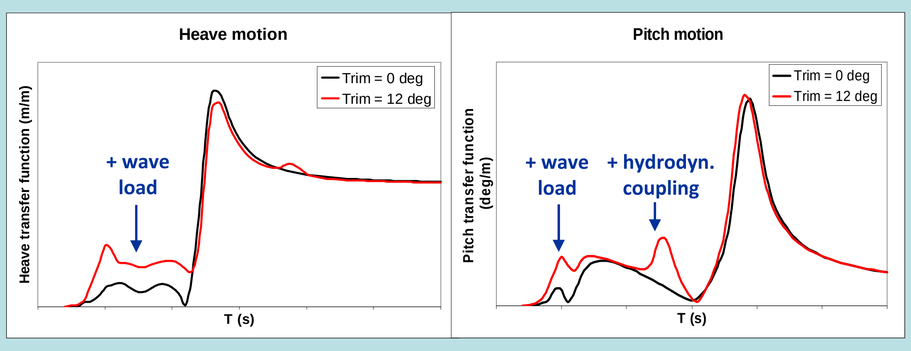
Static equilibrium trim angle under 50-yr return, 1-minute averaged wind speed = 12°.



Calculate hydrodynamic loads and coefficients for new hull (linear potential BEM: *AQUA*+[1]).



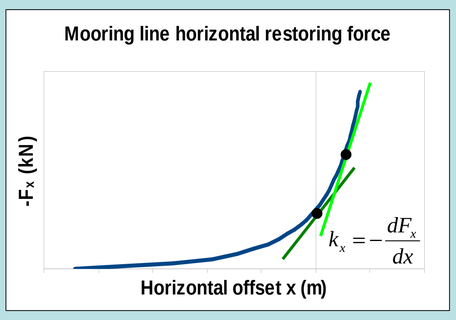
Solve Equations of Motion in the frequency domain:
- Increased hydrodynamic coupling, esp. heave & pitch;
- Increased heave and pitch excitation at low periods.



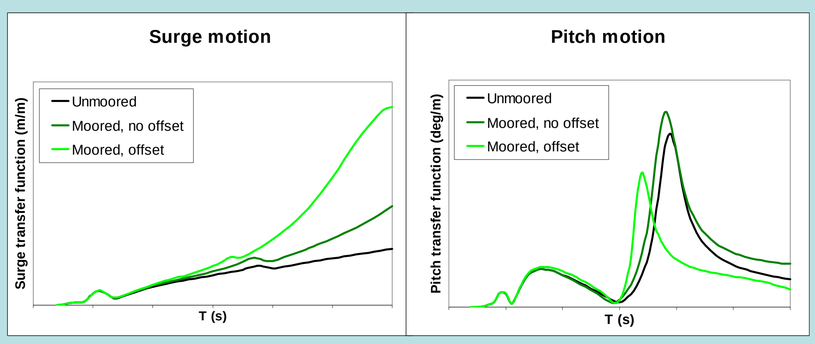
1. Developed by École Centrale de Nantes

Horizontal offset and nonlinear mooring stiffness

Mooring restoring forces are nonlinear. Thus global K matrix is a function of wind/ wave/current induced offset.

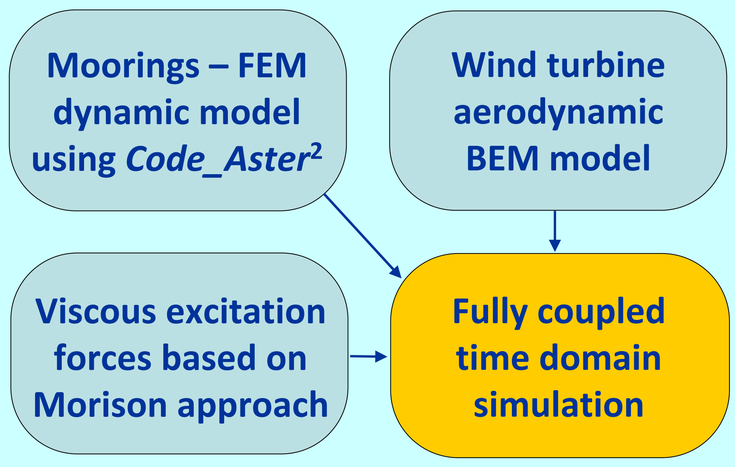


Solve Equations of Motion in the freq. domain:
- Increased surge response at large T: resonance;
- Left-shift in pitch natural period.



2. Developed by EDF R&D

Future steps



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