Fluiddynamik und Schiffstheorie

TUHH
Technische Universität Hamburg

Date
September 8th, 2020

Place: TUHH
Am Schwarzenberg Campus 5,
Building H, Audimax I
21073 Hamburg

Start:
14:30
End:
18:30

Organizer
Institute for Fluid Dynamics and Ship Theory (FDS)
Hamburg University of Technology (TUHH)

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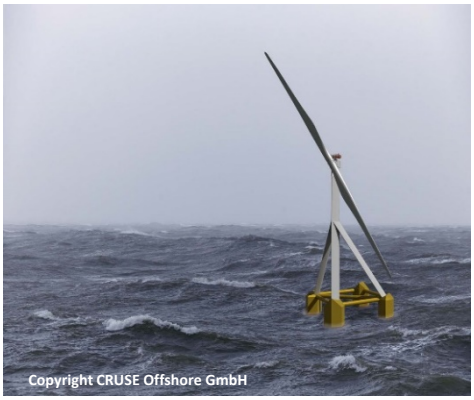
Handout for press conference

Presentation of the SelfAligner concept for a floating wind turbine

Within the framework of the BMWi joint research project HyStOH, the SelfAligner concept for a floating wind turbine was investigated and optimized by the Hamburg University of Technology (TUHH). The investigations were carried out in cooperation with scientific and industrial partners. A special feature of the turbine is its passive wind tracking system, with which the entire platform is able to align itself in the wind. For this purpose, the platform is anchored by a turret buoy that allows the entire platform to rotate freely around the mooring point. In addition to the rotor, an airfoil-shaped tower provides the necessary forces for alignment in the wind.

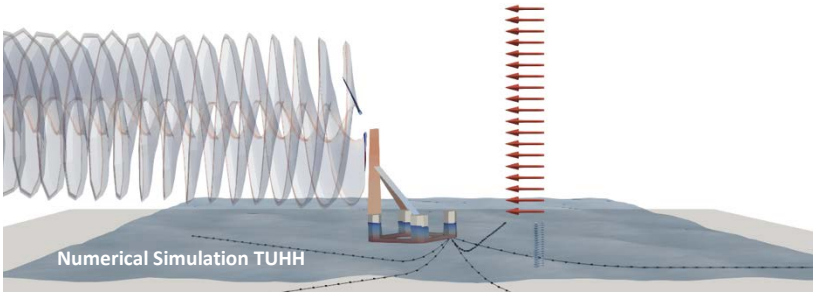


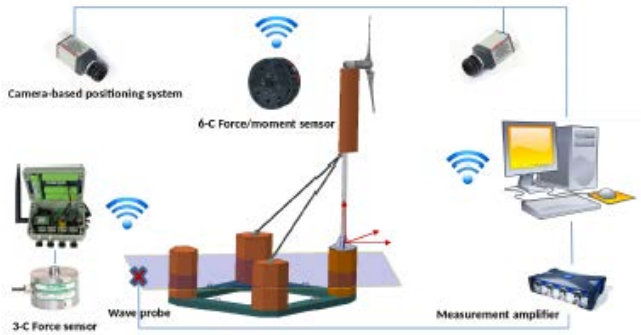
The nacelle of the wind turbine is mounted directly on the tower since no yaw bearing is required to turn the rotor. The rotor is arranged downwind behind the tower. Due to the aerodynamic shape of the tower, its wind wake is reduced, which has a positive effect on the dynamic load on the rotor blades. Thus, the blades experience a significantly lower impact load as they pass the tower.
The platform is characterized by a cost-effective, lightweight construction that can be produced at conventional shipyards without modifications to production facilities. Compared to fixed-bottom structures (including monopiles), the environmental impact of the installation is much lower, since only mooring cables are attached to the seabed.
This novel concept was developed within the BMWi joint research project HyStOH. The project partners are CRUSE Offshore GmbH, the Technical University of Hamburg with the Institute for Fluid Dynamics and Ship Theory and the Institute for Ship Structural Design and Analysis, DNV GL, aerodyn GmbH, and Jörss-Blunck-Ordemann GmbH.
The Institute for Fluid Dynamics and Ship Theory used their in-house method, *panMARE*, to analyze the motion behavior. For this purpose, new methods for determining the forces induced by the mooring lines and for calculating the rigid body accelerations were implemented. The results were used to optimize both the geometry of the platform and the arrangement of the tower in order to achieve the best possible wind alignment.

Floating wind turbines can experience considerable hydrodynamic forces and accelerations in rough seas. To ensure their structural integrity and to evaluate their performance, it is important to consider fluid-structure interaction (FSI) and to analyze the influence of aerodynamic and hydrodynamic forces on the motion behavior of the structure and the resulting loads on the individual components as well as on the entire platform. For this purpose, the Institute for Ship Structural Design and Analysis developed new methods and software to perform extensive FSI simulations for the SelfAligner floating offshore wind turbine.
In addition to the numerical simulations, a model of the platform was investigated in a wave tank. Here, a wind machine was constructed and the motion behavior of a 1:45 scale model was measured under the influence of wind and waves. The measurement results were then used to validate the developed simulation method.

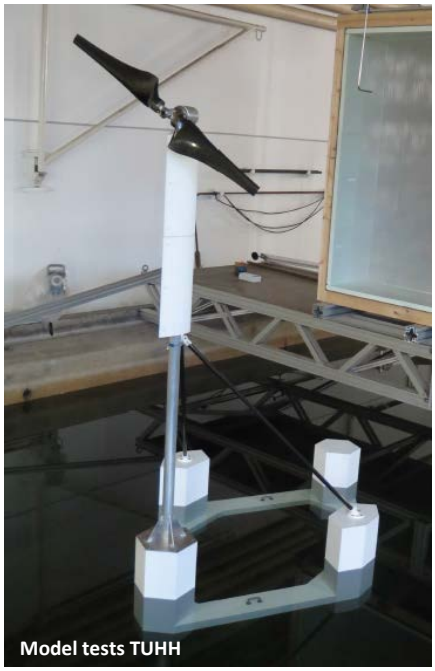
Summary:

- Semi-submersible structure for water depths higher than 40m
- Passive wind aligning through profiled tower and downwind rotor configuration
- Single point mooring (turret buoy) allows free rotation around the anchor point
- Low tower wake due to airfoil-shaped tower
- Low dynamic impact induced by the tower, therefore more flexible blades are possible
- Easy installation and removal due to detachable single-point mooring
- Reduced environmental impact during installation due to using "suction buckets" or gravity anchors





Test setup TUHH



Participating companies and institutes:

https://cruse-offshore.de/index.html
https://www.tuhh.de/fds/research/completed-projects/hystoh.html
https://www2.tuhh.de/skf/fluid-structure-interaction-and-optimization-of-a-floating-platform-for-offshore-wind-turbines-fsiopt/