TRL+ - ACCESSIBILITY

The Decision Support System (DSS) included in BIMEP includes, a part from the classical metocean nowcast and forecast, an accessibility module capable to evaluate the coupled dynamics of a floating concept and a crew transfer vessel. This is a crucial issue for O&M strategis and the management of the different tests at Bimep. Running floating wind turbines in a long-term perspective still presents large uncertainties, due to the exposure of such systems to severe metocean conditions and the short experience with full-scale prototypes. Generally speaking, boats can ensure personnel transfer in two ways: either landing on the wind turbine through a fender and a structure-mounted ladder or using gangways through which people can walk to the wind turbine. Due to the Bimep characteristics, the main accessibility system will be by structure-mounted ladder.

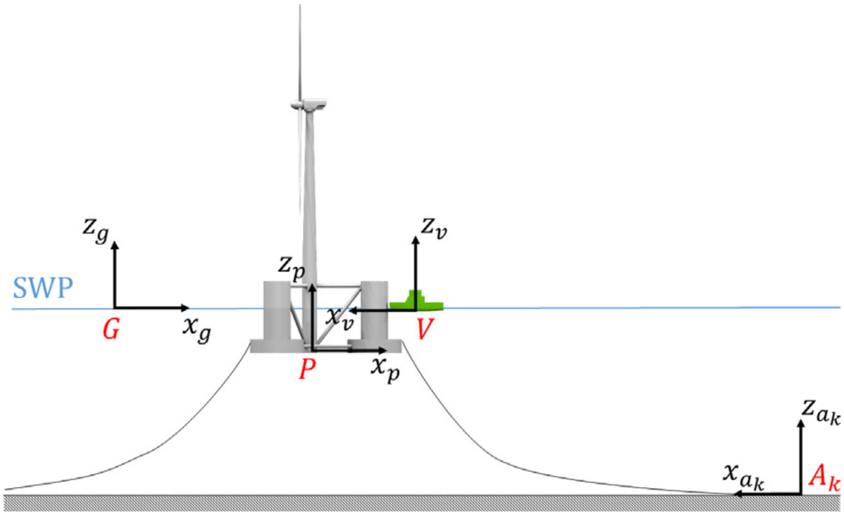
A proof of concept is shown here. It attempts to evidence the technical capabilities that TRL+ provides as a potential service provider. The floating platform chosen in this study is the OC4 semi-submersible, designed by the National Renewable Energy Laboratory NREL. This system is conceived to support a 5MW wind turbine and is composed of a main column and three off set columns (equipped with heave plates). It is moored to the seabed by means of three catenary lines. The platform is assumed to be approached, for inspection or maintenance, by a small crew transfer catamaran vessel equipped with a fender on its bow.

The methodology proposed it is based in a multi-body hydrodynamic frequency domain simulation. A frequency domain approach implies the assumption of linear force-displacements relationships; therefore, potential non-linear phenomena have been linearized accordingly, including the mooring system. A set of transfer functions are built upon the basis of the motion restrictions of a coupled vessel-platform system. Based on them it is possible to calculate short-term response given certain wave conditions and statistical assumptions.

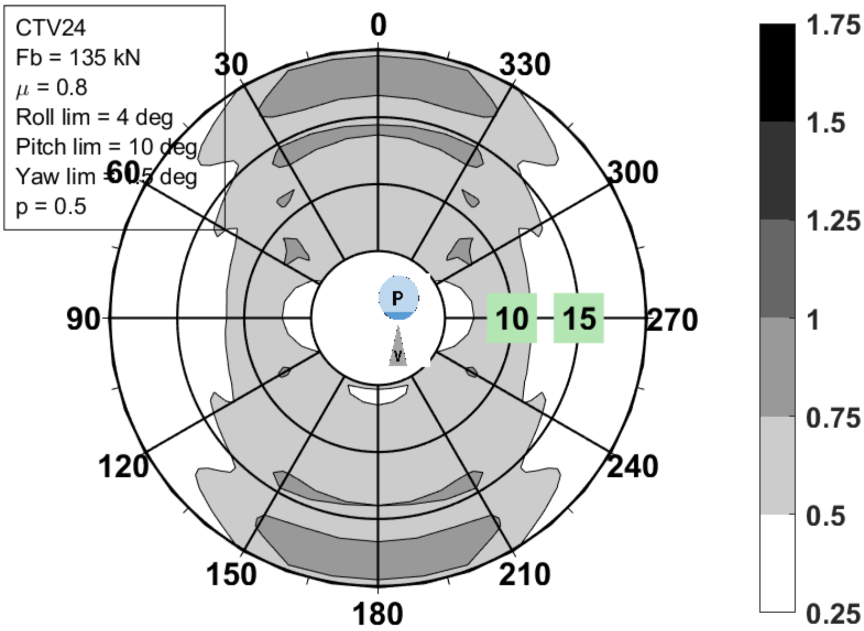
More information about the methodology applied can be found in:

Guanche, R., Martini, M., Jurado, A., Losada, I. J., Walk-to-work accessibility assessment for floating offshore wind turbines, Ocean Engineering, Vol. 116, 2016, 216-225.

It has to be noticed that the implementation carried out in TRL+ includes the following restrictions to the relative movement between the vessel and the platform, which are more complex that those included in the Guanche R. et al 2016 in order to have a more realistic performance of the system: relative yaw, pitch and roll limitations and relative vertical displacements.



The results of the calculation of limiting significant wave height are shown in the following accessibility rose, a polar diagram, where the angular position indicates the wave heading with respect to the vessel while the radial position indicates the wave peak period. The limiting significant wave height was computed comparing the relative movements transfer functions with the operational limits shown in the top left corner of the figure, where the confidence factor (p = 0.5) is also shown.



Finally, when the accessibility rose is known, computing the accessibility for the current sea state only implies considering the platform orientation and doing a simple 2D interpolation.

References

[1] Raúl Guanche, Michele Martini, Alfonso Jurado, Iñigo J. Losada, Walk-to-work accessibility assessment for floating offshore wind turbines, Ocean Engineering, Vol. 116, 2016, 216-225.