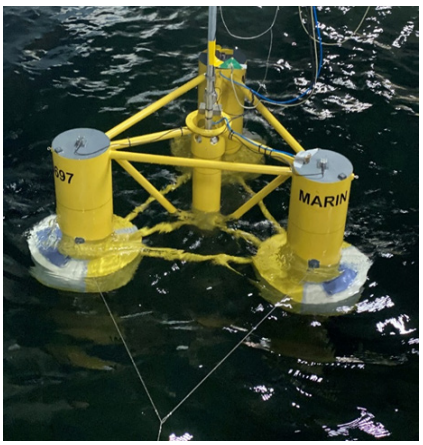
Determine the seakeeping of your FOWT during transit

Evaluation of the seakeeping response during towing operations

The motion response of a FOWT being towed is a complex combination of hydrodynamic influences, including first order wave diffraction loads, non-linear added mass and damping, low frequent wave loads, fishtailing, VIM and galloping. Detailed evaluation of the seakeeping response during towing operations is required to determine the duration and costs of the operation and to avoid unexpected delays. MARIN has applied and validated its existing methods to evaluate the seakeeping of FOWTs during transit.

Services:

- Concept/ design phase: numerical evaluation of the seakeeping response during transit
- Verification phase: FOWT towing tests in waves to validate simulations and reveal unexpected behaviour
- Operational phase: voyage simulations to determine the operability of marine operations



DeepCWind FOWT at transit draft during towing tests in waves

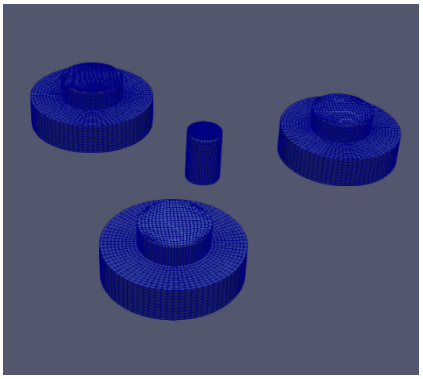
The maturing Floating Offshore Wind Turbine (FOWT) developments and increasing size of these developments drive the need to optimise transportation and installation (T&I) operations further towards an industrial optimised approach.

The in-place seakeeping response of FOWTs is well addressed in the design phase. However, the seakeeping characteristics during transit are less addressed, whereas transportation and installation are a substantial financial factor in the development. Furthermore, the FOWT's need for heavy maintenance campaigns and the often followed disconnect and tow-to-shore approach drive the need for thorough evaluation of the seakeeping response during towing operations.

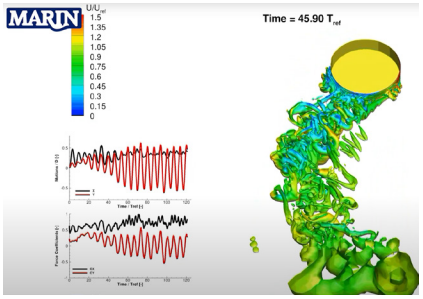
MARIN has more than 85 years of expertise in hydrodynamic evaluation and has applied and validated its existing methods to evaluate the seakeeping of FOWTs[1] during transit MARIN assists in various phases of the evaluation of the towing operation: during the design and verification of the FOWT and during operational planning.

Concept/ Design phase

In the concept and design phase numerical evaluations allow to determine the motion response of your FOWT, while being towed at forward speed and transit draft. MARIN's frequency domain code SEACAL allows to calculate the linearised seakeeping characteristics. Time domain code aNySIM-XMF allows to take non-linear damping and second order wave loads into account. High fidelity CFD analysis allows to evaluate the low frequent horizontal (fishtailing) and vertical (galloping) behaviour.



Panel distribution of the DeepCWind FOWT at transit draft



Vortex Induced Motion (VIM) simulations by CFD

Related products:

- Hydrodynamic evaluation of floating wind turbines
- Evaluation of wind turbine support and O&M vessels
- Evaluation of wind turbine installation vessels (WTIV)

Verification phase

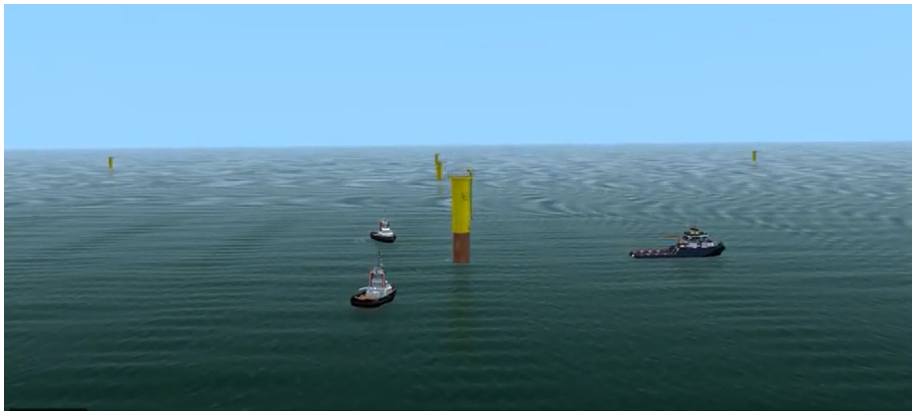
In the verification phase model tests can be performed in waves one of MARIN's towing basins. These tests allow to verify the complex hydrodynamic addressed numerically in the concept/design phase and can reveal unexpected non-linear hydrodynamic effects not captured by the numerical simulations.

Operational training

The procedures and capabilities of the vessels for transportation and installation (T&) can be evaluated on MARIN's real-time bridge simulators. Real-time bridge simulations allow to mimic the operation including all hydrodynamic effects, operational steps and vessels involved. These simulations help to identify and eliminate bottlenecks in the operations as well as to train for these complex operations.

Operational planning

Voyage simulations are an important aid in design choices, operational decisions, risk assessment, planning prediction and many other activities. With increasing needs to optimise operations and mitigate risks, combined with increasing computational power, the use of voyage simulations in the maritime sector's daily practice keeps growing. To evaluate the operability of voyages MARIN has developed the SafeTrans tool. SafeTrans allows to configure vessels, routes and voyages to use in long-term time-window simulations that predict speed and motions at specified time intervals.



Real-time simulator training of a FOWT towing operation

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[1] Ramachandran, R. C., A. Otter, Jj Serraris, Ej De Ridder, C. Desmond, and J. Murphy. 2023. "A Study of the Towing Characteristics of a Semi-Submersible Floating Offshore Wind Platform." Journal of Physics: Conference Series 2626(1):012043. doi: 10.1088/1742-6596/2626/1/012043.