

Extreme wave loading on offshore wind turbine foundations

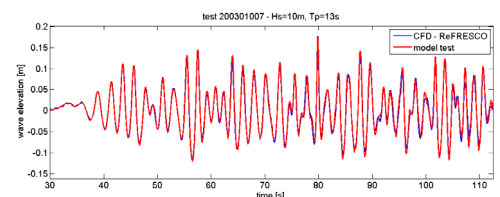
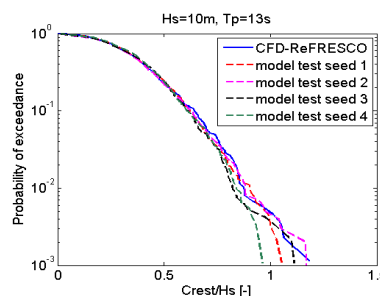
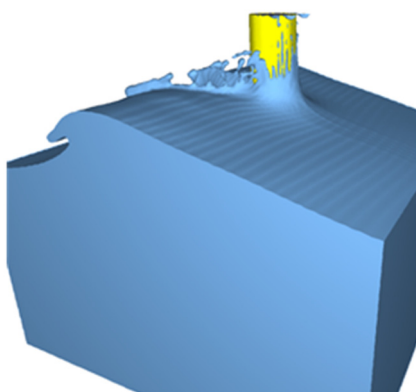
Nowadays Offshore wind turbines are placed further offshore in less sheltered locations in more extreme wave conditions. To ensure the structural integrity of your foundation design it is important that the effect of these extreme waves is accurately taken into account. MARIN has a long track record on extreme wave loading on offshore foundation for Oil & Gas and offshore wind. Therefore we are in the position to offer services and advice on extreme wave loading on your offshore wind turbine. Through state-of-the-art numerical models and model test campaigns the extreme wave loading can be determined. These assessments will provide you adequate input to understand structural viability of your foundation design.

Services:

- Design phase: determine the 50-year extreme wave kinematics' and wave load to assist in the design process
- Validation and verification: Model tests to verify design and validate numerical models
- Full scale monitoring: ensure safe operations of offshore wind turbine

Design phase: determine the 50-year extreme wave kinematic and wave load to assist in the design process

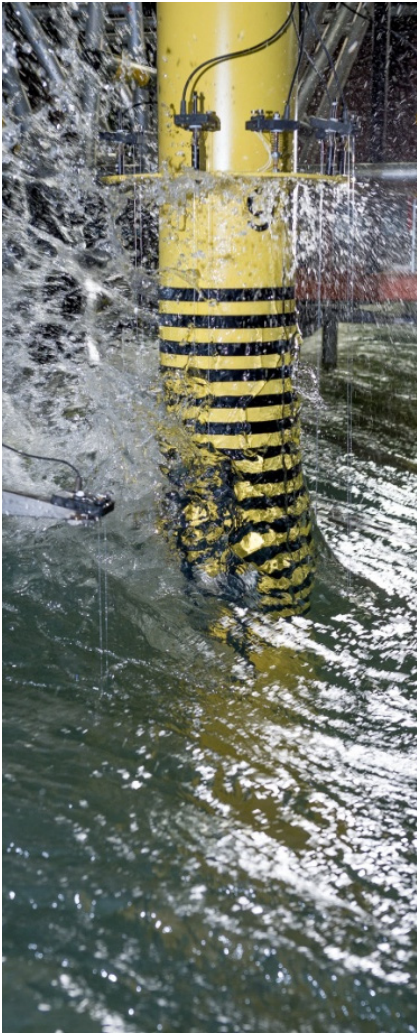
In the design phase, MARIN offers model tests in a wave basin and CFD simulations to assess the (extreme wave loading). This assessment can support you in understanding the extreme wave loading on your foundation for the prevailing sea state at your site of interest. MARIN can conduct this feasibility assessment by means of our in house CFD code ReFRESKO and Comflow which have been extensively validated within the WiFi JIP. Within the CFD code ReFRESKO a full 3-hour 50-year extreme storm can be simulated in 2D giving the extreme wave kinematics and loading on your offshore wind turbine foundation.



Calculated 3-hour wave train with MARIN's in-house code ReFRESKO compared to model tests results for an extreme sea state

Validation and verification: Model tests to verify/validate performance

MARIN can independently verify and validate the offshore wind turbine foundation design and perform a check if the system meets requirements and specifications as set out by e.g. major certification bodies.



Related products:

- WT landing platform alignment
- Wind farm traffic safety assessment

For more information contact MARIN:

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Full scale monitoring: Ensure the safe operation of your offshore wind turbine

When the offshore wind turbine is in operation, full scale monitoring can give further insight in the performance of the design. For this MARIN's trial and monitoring department can perform these measurements campaigns using their wide experience from the offshore Oil & Gas market.

State of the art tools

MARIN has been developing viscous flow CFD codes since the beginning of the 1990's. The philosophy behind our own CFD code ReFRESKO is "Reliable", "Fast" and dedicated to "ships and offshore constructions". This is reflected in robust developments, and combining proven technology with new trends. Special attention is paid to accuracy within all ReFRESKO developments: code verification, solution verification and solution validation is done for any new application. In order to perform large calculations, MARIN has its own cluster, with 4000 cores available. Detailed assessments can be carried out in our high-end wave basins to gain insight into the global loading on the foundation. But also local loads on boat landing and the dynamic response of the structure can be measured. These model tests are essential in proof-of-concept demonstration and in certification for non-standard designs.

Expertise and experience

MARIN is an independent and innovative service provider specialising in hydrodynamic assessments and investigations. With over 80 years experience, we fully conversant with challenging metocean conditions in Oil & Gas and renewable energy projects worldwide. MARIN offers services for hydrodynamic analysis of various types of floaters, installations and operations offshore. Our expertise includes concept validation, seakeeping, slamming, operability assessments, hydrodynamic assessments on installation and maintenance operations, motion compensation and control, mooring, dynamic positioning and logistic scenario analysis.

This expertise and experience is combined in performing wave impact studies on fixed offshore wind turbine foundations. Thereby, CFD simulations and model tests are carried out to gain insight into the extreme wave loading and the response of the foundation:

WiFi I and II JIP 2012-2017

This project gave improved insight in the field of (extreme) wave impacts on fixed offshore wind turbine foundations by means of experimental verification by model testing, numerical calculations, full-scale measurements and industry experience.

ComMotion JIP 2015-2018

Development of fast and efficient CFD method for predicting wave loads on moving and deforming structures in extreme waves