MODEL TESTING FOR OFFSHORE DEVELOPMENTS AND INNOVATION

DHI TEST FACILITIES – CAPABILITY AND EXPERIENCE

Physical model testing – or scale model testing – of hydraulic and hydrodynamic processes is essential for engineers and scientists describing and understanding the complex physics of air-water-structure-seabed interaction. Today, physical modelling is an established tool which bridges the gap between what can be simulated accurately using numerical models and the real world. It is crucial for DHI to be able to combine the unique strengths of model testing with advanced numerical modelling to solve challenges presented by our clients.

OUR EXPERTISE IN MODEL TESTING OF WAVE-STRUCTURE INTERACTION

Experimental hydraulics is one of the fundamental disciplines at DHI. Since DHI was established in 1964 our ambition has been to apply waves with the best reproduction of all important wave characteristics in our laboratories.

DHI was pioneer in the development of the hydrodynamic background for accurate 3D wave modelling, and their results and experience have been implemented in DHI's experimental facilities enabling us to solve the toughest challenges in offshore water environments. Our hardware and software model testing technologies have been adopted by more than 80 laboratories around the world.

DHI's model test facilities located at the head office in Hørsholm, Denmark

Although numerical modelling of loads and response of floating and fixed structures has matured due to validation against physical experiments and real life verification, experimental methods are still the primary choice for study of wave interaction with certain complex structures in harsh offshore environments. DHI's experimental offshore facilities are attractive for the offshore industry due to our skilled and innovative staff and specialists who have years, even decades, of experience.

CLIENT

- Offshore oil & gas industry
- Offshore renewable industry
- Shipping industry
- Contractors
- Consultants
- Authorities
- University and R&D institutions

CHALLENGE

- Load conditions and response of complex structures in extreme environmental conditions (wind, waves, currents)
- Uncertainty or inaccessible numerical modelling tools
- Cost-ineffective solution and uncertain safety levels

SOLUTION

- Physical model testing is an efficient and well-proven technology for assessment of load and response of complex fixed and floating structures
- Provision of test results to calibrate and validate (or disprove) numerical model results
- DHI's facilities offer deep and shallow water test environments with multidirectional waves, current and wind conditions

VALUE

- Measurements of forces, pressures, motions and accelerations for rare extreme conditions
- Basis for safety and downtime assessment
- Model testing provides an immediate qualitative impression of the physical processes
- Fundamental problems of designs and operations are immediately demonstrated during model set-up and execution

OUR EXPERIENCE

DHI has been testing for the offshore industry for more than 30 years within a wide range of fields - in deep and shallow waters:

- Floating production, storage and offloading (FPSO)
- Offshore loading facilities
- Transportation of offshore structures by tow or on heavy lift vessels and barges
- Installation of topsides, jackets and gravity structures
- Extreme wave kinematics, including wave-in-deck
- Wave run up, overtopping and breaking wave impact
- Fixed and floating wind turbine foundations
- Wave energy converters
- Pipelines and risers
- Seabed erosion and scour protection (gravity based foundations)

WORKING WITH OUR CLIENTS

We have proven that close collaboration with our clients, the technology and knowledge transfer as well as involvement of multidisciplinary expert teams are key parameters in ensuring the highest value and outcome for our clients on time and cost.

The initial activity for a new study programme is to determine the optimal model scale ratio and test programme.

Our specialists assist in creating an optimal study considering the characteristics of the actual facility and the specific requirements and tolerances specified by the client. Also the data analysis procedure is ideally agreed upon at this time.

The ideal facility for testing of innovative solutions

Model experiments are effective and efficient tools for early assessment of concepts and ideas for marine and offshore development. Studies can comprise full development concepts as well as details of structures. We have shown that our model test facilities are ideal for such testing, and easily accessible at attractive pricing. DHI's modelling teams welcome the participation of Client's own staff in test execution and data analysis.

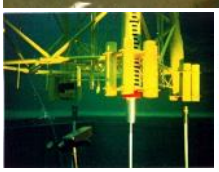
Why 3D waves and wind are important

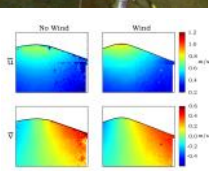
Testing in multidirectional waves provides more realistic response of floating structures in extreme sea states. Moored offshore structures will often depend on adjusting to the optimal orientation relative to wind and waves. Unidirectional waves may in such cases result in too optimistic designs as transverse impact is underestimated in the modelled wave field.

Once the planning has been completed, the model construction will go forward, followed by installation, instrumentation setup, calibration and other pretests, exercises and testing.

OUR MODEL TESTING FACILITIES

- Deep water basin: 30 m x 20 m, 3 m water depth for 3D waves, current and wind, centre pit to 12 m depth
- Shallow water basin: 35 m x 25 m, 0.20-0.80 m depth for 3D waves, current and wind
- Flume: 28 m x 0.74 m, 1.2 m high flume for waves
- PCs equipped with the DHI Wave Synthesizer package controls the wave generation as well as data logging and postprocessing analysis
- 3D wavemakers in the shallow basin are equipped with the 'DHI AWACS' - the unique Active Wave Absorption Control System developed by DHI
- Movable wind generating fan systems can be installed in the facilities when required





Contact: hkh@dhigroup.com or juf@dhigroup.com
For more information, visit: www.dhigroup.com