Vessel Response Tool

A Showcase for Response-Based Design Optimization

Open-access on vrt.sintef.no

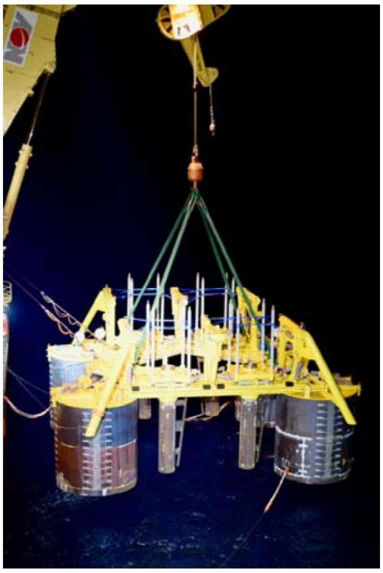
The offshore industry in northern Europe is operating increasingly large installations in exposed areas, requiring high reliability and availability. Downtime of those large and complex offshore systems leads to significant financial losses. Attention is on vessel designs for installation and maintenance, which are insensitive to weather, as a requirement to operate safely in high sea states. Here, a key aspect is the optimization of hull geometry, aiming for a reduction of vessel motions in waves.

The objective of this project is the development of a tool providing guidelines for design optimization and vessel selection based on the specific requirements of a marine offshore operation. Here, the project is utilizing former research results obtained within the Norwegian Centre for Research-based Innovation on Marine Operations (SFI MOVE) for the evaluation of vessel performance.

RESPONSE-BASED DESIGN OPTIMIZATION

The Vessel Response Tool is designed to support decision-making processes where a quick and simple analysis of motion response behavior of various ship designs for benchmarking or vessel selection is needed. Hence, the Vessel Response Tool can be used for design optimization at the early design stage, where the optimal hull size for a specified work task and sea area is needed, or for the selection of the best suitable vessel for an intended offshore operation. The tool enables the user to evaluate and compare mission dependent ship motion behavior based on the vessel's main characteristics, motion limitations, and environmental data.

In contrast to other available tools on the market, the



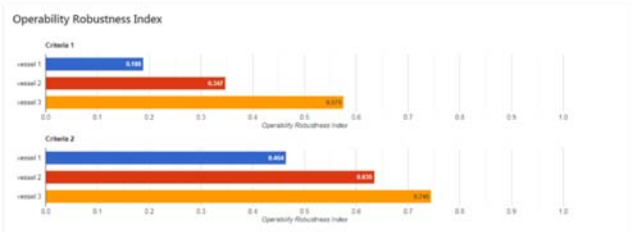
Vessel Response Tool is openly accessible on vrt.sintef.no. Further, it does not require any advanced hydrodynamic expertise nor exact geometrical hull descriptions.

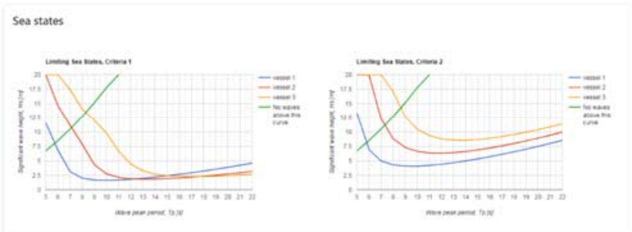
Based on the vessel, operational, and limitation input data the tool delivers an approximation of selected performance parameters, such as:

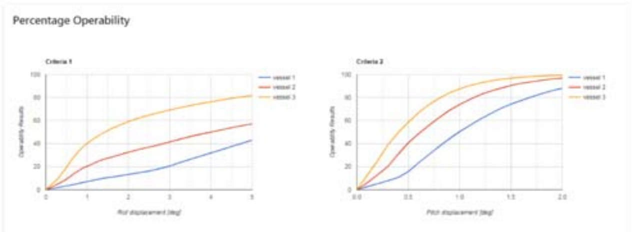
- Limiting sea states for non-exceedance of the specified operational criteria.
- Percentage operability (operational time) based on environmental data of the specified sea area and motion characteristics (RAOs).
- Operability Robustness Index (ORI, formerly nominated Integrated Operability Factor, IOF).

The latter parameter was newly introduced as performance indicator for vessel response motion behavior showing the level of operational performance for limitations lower than the specified input. Mathematically described, the ORI indicates how quick the percentage operability curve converges (steepness of the curve).

The results are established based on motion transfer functions (RAOs) for 2835 ship geometries of different size and loading conditions, all calculated based on a generic hull geometry of an offshore construction vessel in operation since 2014. For a practical estimation of the dependency of motion responses in waves the accuracy is sufficiently high. A comparison against a variation of other hull geometries leads to an accuracy level in terms of standard deviation for the ORI of 7.7% for roll, 3.3% for pitch and 1.8% for heave at COG. For further information please refer to OMAE2017-62307 proceedings: Design Parameters for Increased Operability of Offshore Crane Vessels.







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