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Model Tests on Tanker-Turret Systems

1 PURPOSE OF PROCEDURE

2 MODEL TESTS ON TANKER TURRET SYSTEMS

2.1 Calibration Of Current

- At the projected location of the turret of the tanker a homogeneous current has to be adjusted over the full width or a sufficiently large part of the width of the basin.

- The uniform current velocity will be measured at a depth corresponding to half of the draft of the fully loaded tanker and at sufficient number of locations abreast of the projected location of the turret.

- At the projected location of the turret of the tanker a current distribution over the vertical may be measured.

2.2 Calibration of Waves in the Presence of Current

- For the calibration of long-crested waves a minimum of two wave probes are installed. One is placed at the projected turret location, and this one has to be removed during the actual tests. One probe has to be placed abreast of the former one in order to be used for the wave-phasing with regard to the measured signals.

- The wave spectrum is calibrated in the presence of the adjusted current for a duration corresponding to the test duration.

- The target of the wave calibration is the spectral shape as provided by the client.

Documentation of additional characteristic's are. provided for at least:

* distribution of the wave heights
* distribution of the wave elevation
* spectral shape of the wave grouping
* distribution of the wave grouping

2.3 Calibration of the Mean Wind Force

- With the batteries of fans in place in the basin a homogeneous wind velocity over a sufficient large area of the test set-up are adjusted. The nominal wind velocity at the projected location of the ship will be adjusted at a level of 10 m (full-scale) above the water level by means of for instance a propeller-anemometer.

- With the installed model in the basin, the fans are run for a duration of at least a half an hour full scale, and the mean turret force is measured. The measured force is compared with the calculated wind force. If necessary, the RPM of the fans are adjusted to obtain the specified mean wind force.

2.4 Installation and Static Load-Deflection Curve of the Mooring System

- Before the individual lines will be laid out first each line has to be stretched up to the breaking strength. This is necessary to eliminate a possible coil in the mooring leg and to judge possible plastic deformation of the spring and in the model chain(s).
- Next each line will be pulled out in the basin and connected to the exact location of the anchor point. Than by means of a dummy turret for each individual line the chain force versus the horizontal displacement of the "turret" in the direction of the line has to be determined and compared with the theoretical ' one (static load-displacement curve for the individual lines) and documented. Normally the (small ring-shaped) force transducer in the chain is incorporated in the top end of the line close to the turret attachment point.

- After all lines are adjusted they will be connected to the turret system during the installation of the tanker in the basin and the pretensions are measured and documented. Finally the static load-deflection curve of the total system has to be measured (assuming a symmetrical system). For these measurements the tanker will be pulled out stepwise. During the static load-displacement measurements the individual chain forces, the horizontal force as measured by the transducer incorporated in the turret and the tanker displacements (as measured with a tanker tracking system) will be recorded. The tanker will be pulled over a distance which corresponds to the breaking load of the heaviest loaded line. The measured and theoretical results will be documented.

- From this extreme position of the tanker the pulling force will be stepwise reduced and the same signals as before will be measured. This static load-displacement curve may show possible hysteresis effects in the mooring legs. The results will be documented.

2.5 Sign Convention of Tanker Motions and Wind, Wave, and Current Direction

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From the result of the questionnaire it can be concluded that the present ITTC standard for the co-ordinate system and sign conventions is not being used by the offshore industry. Therefore a drawing showing the vessel bound and basin fixed co-ordinate systems and sign convention, numbering of mooring lines and the indication of the basin fixed directions of the wind, waves and current is to be provided. This item has to be elaborated and will be recommended as a future task of the next Committee.

To ensure consistency and reproducibility of model test results by members of the ITTC not only the test procedure specifications as applied to the tankery work must be considered but also attention have to be paid to the statistical treatment of the (combined) wave and low frequency signals as measured during the tests. At least the filtering techniques, sampling, number of spectral lines applied to the measured (or computed) wave and low frequency signals have to be considered. This

work is also recommended as future work of the next Committee.

3 PARAMETERS

3.1 Parameters To Be Taken Into Account

3.2 Recommendations of ITTC for Parameters

4 VALIDATION

4.1 Uncertainty Analysis

None.

4.2 Test - Calculation

None.

4.3 Test - Full Scale

None.

4.4 Benchmark Tests

1) Comparison of Semi-Submersible Wave Motion Calculation (17th 1984 pp. 558-563)
   To Examine the Overall Validity of the Various Calculation Programs, and To Examine Whether or not there was a Correlation Between the Differences in the Various Calculation Methods and the Differences in the Calculation Results Model of SR-192 Project

2) Comparative Data Analysis Study
   (18th 1987 pp.483-492)
   To Compare Analysis Methods for Regular Wave and Irregular Wave Signals

3) Semi-Submersible Comparative Study
   (18th 1987 pp.506-515)

3-1) 17th ITTC Comparative Calculation
   The Natural Periods of Heave Calculated by the 3-Dimensional Potential Theory Programs (3-D Programs) did not Show Good Agreement with the Experimental Values. The Reasons for This Should be Investigated.
   This Through Survey Has Confirmed That The 3-D Programs Predict a Heave Added Mass About 15% Larger and A Natural Period about 5% Longer than That Found by Experiment. The Precise Reason for This Remains Obscure, Although It Is Suspected That Vortex Shedding May Play a Role.

3-2) Moored Semi-Submersible Analysis
   To Investigate the Validity of the Time Domain Analysis (TDA) Programs for the Simulation of Slow Wave Drift Oscillations of a Moored Semi-Submersible, by Comparing the Results of Several Programs with Experiment.

4) Semi-Submersible Comparative Study
   (20th 1993 pp.521-525)