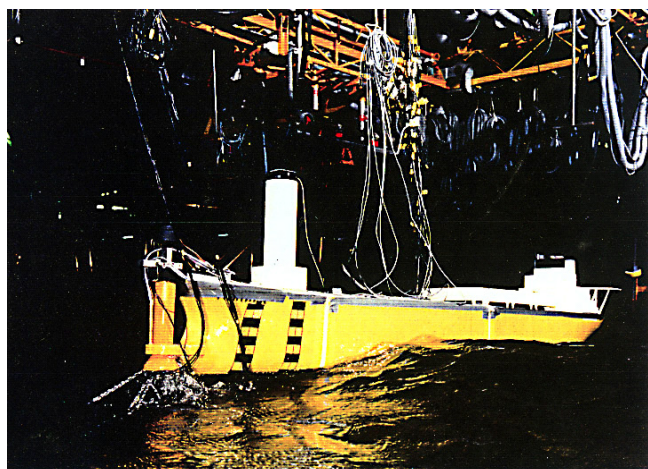


Assessment of dynamic mooring system loads and tanker motions

DYNFLOAT

DYNFLOAT is a time domain simulation program to analyse the dynamic behaviour of a turret or spread-moored FPSO subject to wind, waves and current. The program predicts the mooring loads and tanker motions when the system is exposed to operational or survival conditions.



FPSO

The FPSO is a tanker of regular dimensions. DYNFLOAT includes a database containing hydrodynamic data for several tankers. Based on the main particulars of the tanker a selection from the OCIMF database is made. Through an expert mode a user-defined tanker can be used for the simulations.

Environment

The environmental conditions concern steady or varying current, steady or irregular wind fields, swell and long crested irregular waves coming from arbitrary directions.

Several spectral formulations for wind, wave and swell are available. In the expert mode user-defined wind, wave and swell spectra can be used. It is also possible to use time series for wind, wave and current conditions. The water depth can be arbitrary.

Mooring Systems

Two types of mooring systems are considered.

Turret Mooring

The turret mooring system consists of a tanker with an internal or external turret. The vessel is allowed to weathervane around the turret axis. All mooring lines are connected to the chain table.

Spread Mooring

In the spread-mooring system the mooring lines are connected directly to fairleads on the tanker.

Each mooring leg can consist of a number of anchor chain, steel wire or synthetic rope. For each individual mooring line segment coefficients are defined to account for inertia, drag and seabed friction effects.

Input

The input of data is user-friendly. Default values are available for a number of input items, making it possible to use the program with limited information for the tanker and mooring system. The system layout is represented graphically in a schematic format to detect input errors in an early stage.

Databases

Several databases are delivered with the program.

Mooring elements

The mooring element database consists of particulars of common offshore chains, steel wires and synthetic rope.

ICIMF wind / current data

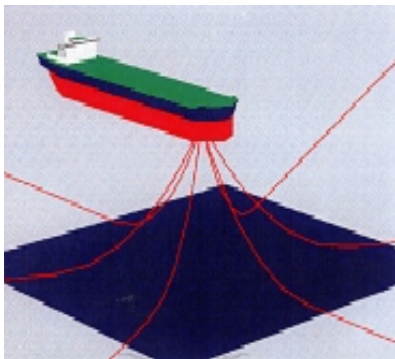
This database contains non-dimensional wind and current force/moment coefficients for use in the calculations of wind and current loads on a tanker.

FPSO diffraction data

This database contains diffraction analyses for several tanker configurations, loading conditions and water depths.

Hydrodynamic reaction coefficients

This database contains coefficients for use in the formulations of hydrodynamic reaction forces. This data is obtained by extensive oscillation tests on three tanker models (both in current and still water).



Simulation Control

The following situations can be simulated:

- Intact condition.
- Damaged condition.
- Transient behaviour after mooring line failure.

The simulation starts either from an arbitrary vessel position or with the mean position. The maximum duration of a simulation is 3.5 hours (0.5 hours swell up period).

Output

The output of a simulation consists of a binary database containing all samples of the calculated signals. The signals include the tanker motions, mooring loads in all mooring legs and other interesting quantities for the analyses of the mooring system behaviour. A comprehensive data processing package is delivered with the program to view, plot and print the output results.

A top view animation is available for visualising the vessel's behaviour. The dynamic behaviour of the mooring legs is visualised with a full 3-D animation allowing to change the perspective.

Validation

Model tests for turret moored tankers, carried out in MAIRN's Wave and Current Basin were used to validate the computer program. The validation program covered the influence of turret locations, environmental conditions and loading condition. A good correlation between model test results and the computations was found.

Note

The program allows evaluating different mooring system layouts in a quick and efficient way with the so-called Quasi-Static option. With this option the mooring line loads are obtained from a data-base with static load versus deflection relations for each mooring leg. For obtaining design loads, this option is valid; the full dynamic computation gives the mooring legs loads, taking into account the inertia and drag effects (due to the relative motion of the mooring leg through the water).

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