

Assessment of mean wave, wind and current forces on ships

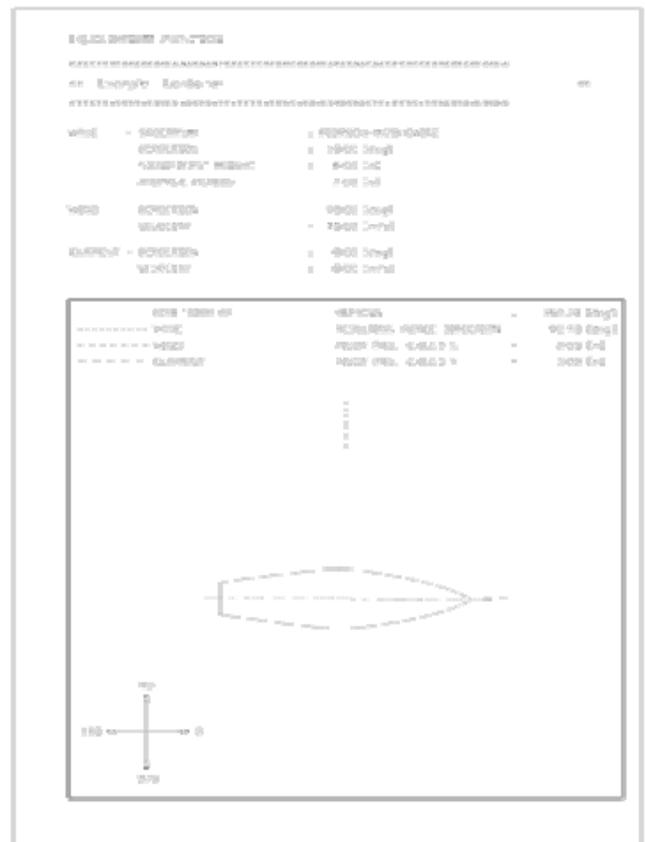
DBSHIP

DBSHIP gives a quick and adequate estimation of the environmental forces on ships. It is particularly suitable for a first estimate of the required thruster capacities for DP vessels, dimensioning of anchor systems, a first estimate of the characteristics of a DP control system and determination of the optimal heading for DP and anchoring. DBSHIP is a useful tool during the preliminary design stages of mooring and dynamic positioning systems. The data provided can be used for studies on exposed locations and single-point mooring systems.

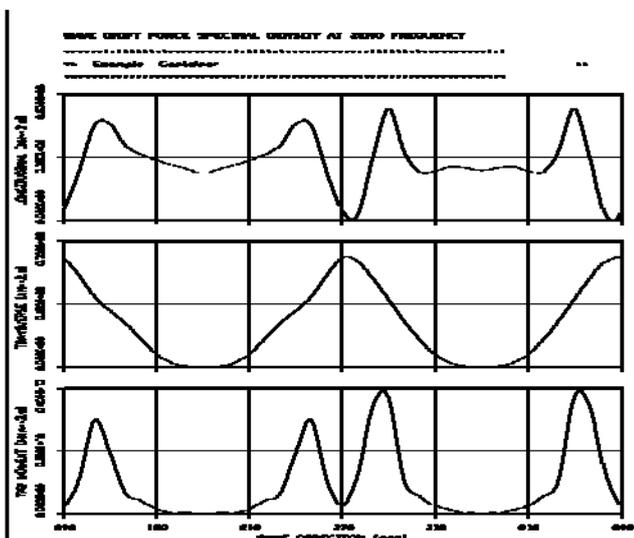
Computational approach

DBSHIP offers a straightforward computation of the mean horizontal wind, wave and current forces on several ship types. It also computes the spectral density of wave drift forces. Using the mooring stiffness as input, DBSHIP estimates the mean and low frequency excursions and mooring loads. Arbitrary wind velocity and direction, current velocity and direction as well as wave condition and direction can be dealt with. The influence of water depth is taken into account.

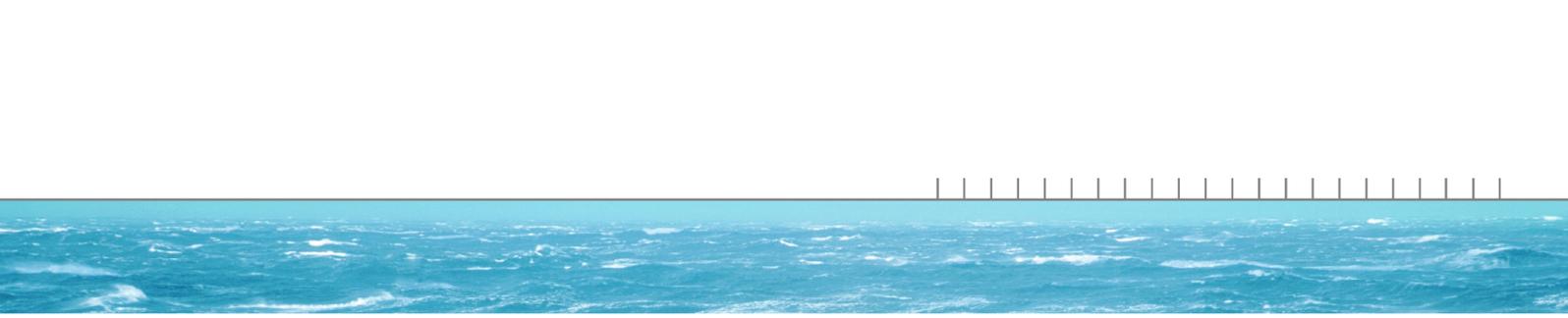
DBSHIP is based on a large number of theoretical and empirical coefficients for wave drift, wind and current forces on tankers, general cargo vessels, diving support vessels, container vessels, supply vessels, ferries, hopper dredgers and drilling vessels.



Equilibrium position of a vessel exposed to wind, wave and current



Longitudinal force, transverse force and yaw moment on a vessel



For each ship type the appropriate data file is connected to the program. For user defined vessels the necessary diffraction data have to be given as well. The ultimate longitudinal and transverse forces and yaw moment are derived by applying the actual parameters of the vessel and the environment to these coefficients.

The second order wave forces are obtained from MARIN's program DBDRIFT. Wind loads are estimated on the basis of wind tunnel experiments.

For arbitrary shapes of hull, deck and superstructure, the wind forces and moments are computed from component loading, taking into account shielding, Reynolds number effects and lift.

Current loads are estimated in the same way as wind loads. The empirical drag coefficients are obtained from model test.

Applications

DBSHIP gives a quick and accurate estimation of the environmental forces on ships, provided that the database limits are not exceeded. It is particularly suitable for a first estimate of the required thruster capacities for DP vessels, dimensioning of anchor systems, a first estimate of the characteristics of a DP control system and determination of the optimal heading for DP and anchoring.

Input

- Vessel main dimensions and displacement
- Loading condition
- Wind exposed geometry (e.g. deck houses)
- Mooring stiffness
- Water depth
- Wave, wind and current data
- Relative directions of waves, wind and current
- Point of rotation for yaw

Output

- Longitudinal and transverse forces due to waves, wind and current for the range of directions
- Yaw moment with respect to the centre of gravity and a user-defined point
- Spectral density of the wave drift forces
- Equilibrium conditions
- Low frequency motions
- Wind forces on user-defined components

The algorithms compute the position of equilibrium and the yaw moment about any chosen point of rotation.

Reference

- Nienhuis, U.; "Simulation of Low-Frequency Motions of Dynamically Positioned Offshore Structures", Royal Institution of Naval Architects Spring Meeting, London, 1986.

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