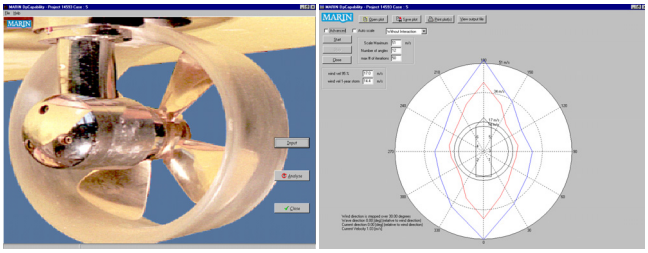
Analysis of thruster capacity in dynamic positioning

DPCAP

Dynamic Positioning (DP) is coming more and more in use. Therefore, it is desirable to know a system's capacity in an early design stage. To be able to do so MARIN developed the software program DPCAP, which generates so-called DP Capability plots. In these plots, the maximum sea state is shown at which a vessel can operate.



Computational approach

The program calculates the wind, wave and current forces on several hull types, available from its database. As an additional option, the program is capable of dealing with user supplied coefficients for wind, wave and current forces. The ship can be extended by up to ten superstructure blocks, which can be chosen from nine different elementary forms. The wind loads on the superstructure elements are then computed, using a building block approach. In this approach also shielding effects are taken into account. External forces due to a mooring system or 'dredging' forces can be included as well.

Since wave forces are largely determined by the wave period, the program uses the relation between the wind speed, the wave height and the mean wave period. This relation can be modified by the user to simulate different locations on earth. To remain on position, the total environmental and external forces on the system must be generated by the available thrusters. Therefore, the total required thrust is distributed over the available thrusters, using a non-linear constrained quadratic optimisation algorithm.

A special feature of the program is the thruster-hull-current interaction and rudder-main propeller interaction. These corrections are based on theoretically and empirically derived coefficients.

Application

The program has been developed with a fully interactive user interface and operates on the Windows 95/98 as well as on the Windows NT platform. It is incorporated into the standard software tools at MARIN. In the nearby future extensions will be made to incorporate the effect of low frequency motions as well as bow tunnel ventilation effects, which occur in higher sea states.

The program was developed in a Joint Industry Project, with the following participants: Dockwise, Smit Engineering, Holland Roer Propellers, Damen Shipyards, Breeman Engineering and Services, IHC Gusto / IHC van de Giessen - De Noord and MARIN.

References

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