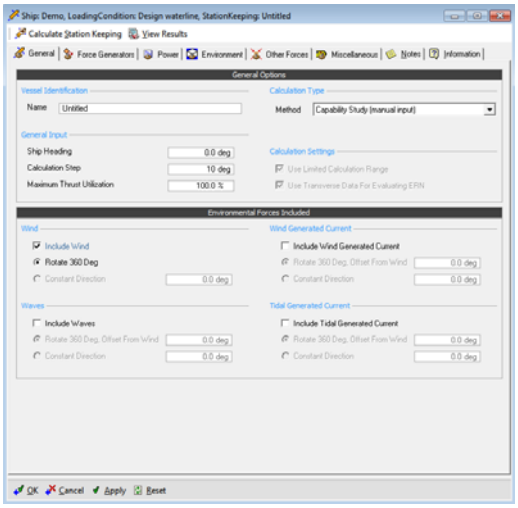
ShipX Station Keeping

A Program for Predicting Station Keeping Performance of Ships

SINTEF Ocean has developed a program for numerical calculation of station keeping performance of ships. The program solves the DP problem statically, and requires a minimum of input, hence it is very well suited to be used in the early design phase. The program is integrated in the hydrodynamic workbench ShipX.

The motivation for developing this software was to enable the ShipX workbench environment to provide the user with station keeping prediction capabilities. In addition, existing programs were complicated to use requiring manual editing of input files, limiting user settings with respect to prediction options and lacking features required by our customers. In the development of ShipX station keeping software, a fast-to use, easy-to-learn user interface has been one of the main focuses.

The station keeping software is integrated as an application in ShipX, and has the same intuitive, easy-to-use user interface as the rest of ShipX. Running the calculations takes from a few seconds up to a few minutes, depending on the speed of the computer, the number of environmental headings calculated for and the calculation method used. As soon as the calculations are finished, reports and plots are available directly from ShipX. Reports and plots can easily be exported to Microsoft Word for quick and easy report generating.



NUMERICAL METHODS

The station keeping software has several calculation modes.

In force generator load mode the user defines the environmental effects. The calculated result is the load on each force generator (see Figure 2).

In capability study mode the user defines what environmental forces to include, and the program will iterate the magnitude of the forces to find the maximum withstandable environmental force for each heading (see Figure 1).

The station keeping program also supports IMCA [1], DNV [2], ABS [3] and DNVGL [4] specific calculation methods.

A number of generic force generators are implemented in the program, including rudder and propeller units. The user can implement their own force generators through an open programming interface (using either Java or Fortran).

The allocation routine implemented uses quadratic programming with minimum thrust optimization. The allocation routine handles thrust saturation, thrust loss and forbidden zones on all force generators. The users can implement their own allocation methods through an open programming interface (using Java).

The environmental forces are based on force coefficients. Databases for wind-, current- and wave drift coefficients for a range of ships are included. Additional coefficients can be imported from open file formats, literature and other software.

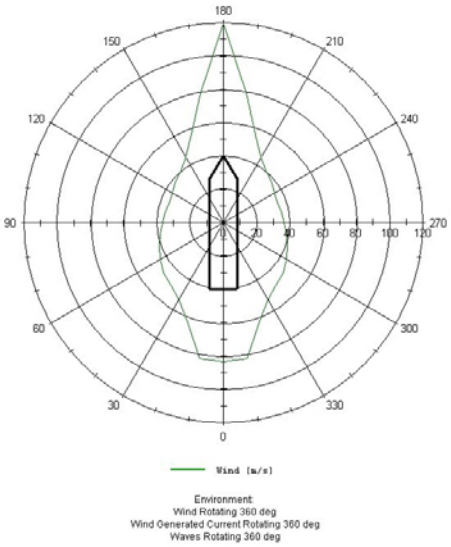


Figure 1, Capability plot example

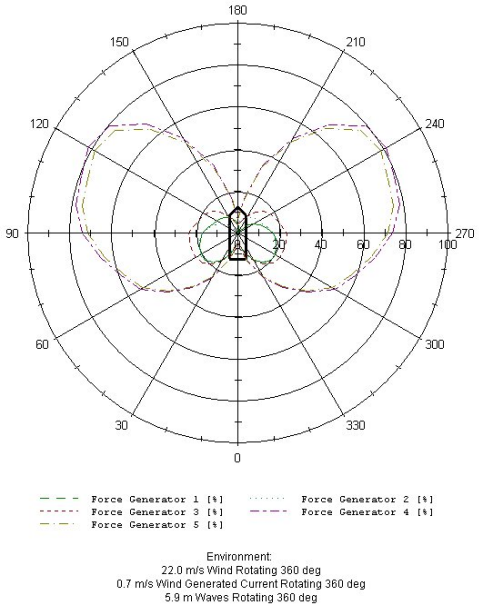


Figure 2, Force generator load plot example

[1] The International Marine Contractors Association
"Specification for DP Capability Plots"
IMCA M 140 Rev 1, 2000

[2] Det Norske Veritas
"Environmental Regularity Numbers"
Pt.6 Ch.7 Sec.7, Rules for Ships, July 2013

[3] American Bureau of Shipping
"Guide for Dynamic Positioning Systems"
ABS, December 2012

[4] DNVGL
"Assessment of station keeping capability of dynamic positioning vessels"
DNVGL-ST-0111, July 2016

SINTEF

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