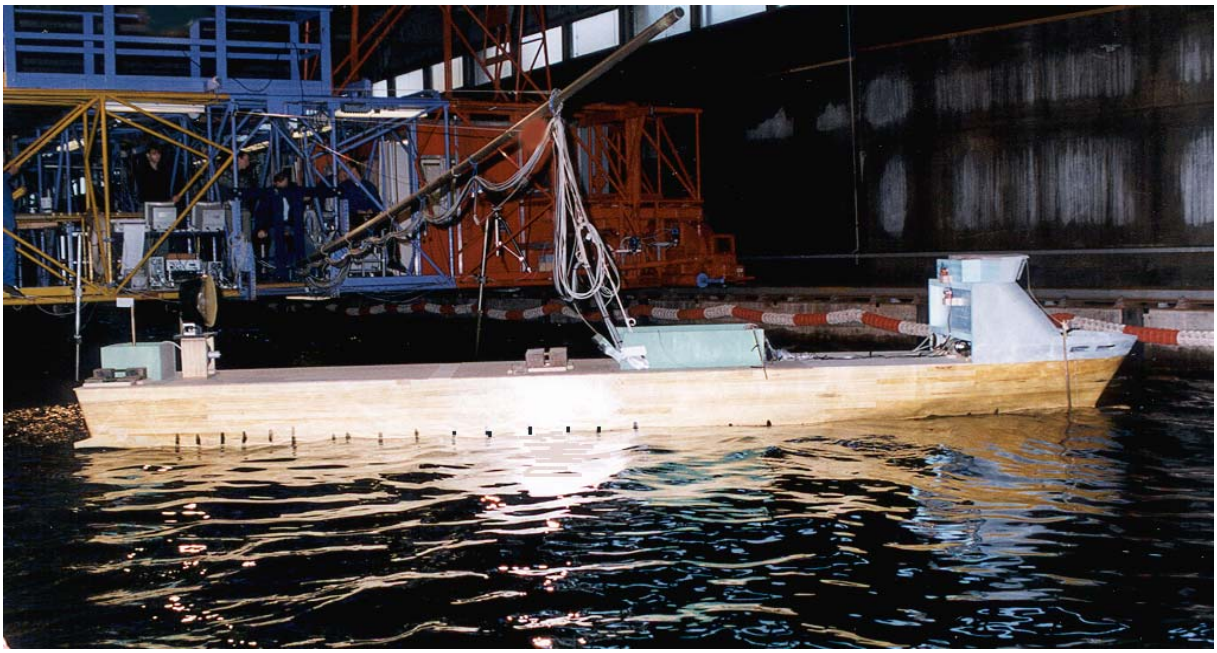
Hydrodynamic Services

Seakeeping and Operability Analysis



Seakeeping tests for a ferry in FORCE Technology's large towing tank

Introduction

For many ship designs good seakeeping performance is essential. Passenger ships, for example, require good seakeeping characteristics to ensure the passengers' comfort, and offshore ships require good seakeeping characteristics to ensure high levels of operability in the working environment at sea.
For a successful ship design good seakeeping characteristics should be incorporated into the design in the initial design phases. At this stage it is still possible to vary the hull geometry or change the positions of locations and areas which are critical as regards motions. Hence, a reliable prediction tool for use in the initial design stage is of utmost importance.

For evaluation of the seakeeping performance in a seaway FORCE Technology has developed the SEAPEP program. As part of FORCE Technology's suite of Initial Design Tools for in-house use, SEAPEP is a fast and reliable program for evaluating and ranking different design alternatives with regard to seakeeping performance.

SEAPEP Features

The seakeeping performance of a ship in a seaway is determined by:

- Size, form and loading condition of the ship.
- Wave conditions.
- Ship speed and heading.
- Operational limits and positions of motion-critical points.

From these input variables the SEAPEP program is capable of calculating the operability of a ship hull form in a seaway for a given set of operational criteria. The effects of changing the input variables can be rapidly evaluated by SEAPEP, so the effects of modifying the hull geometry or changing positions of points with limiting criteria can be evaluated almost interactively.

SEAPEP allows the definition of up to 8 different operational profiles, with up to 15 positions with defined operational limits.

Input Data and Methodology

The basic required input to SEAPEP consists of the following:

- Vessel geometry.
- Loading condition and roll damping devices.
- Wave scatter diagram.
- Speed and heading profiles.
- Operational limits and positions.

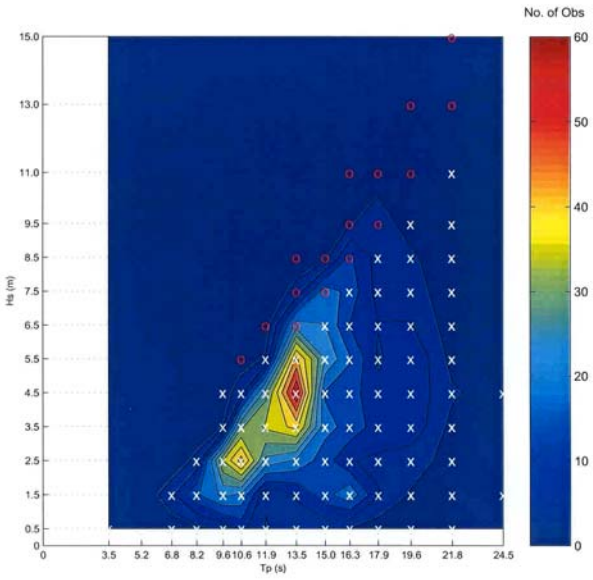
Typically, the motions of the ship are calculated by the FORCE Technology STRIP programme. This program is a linear strip theory code, and the calculations are based on the 3D definition of the hull geometry and the loading condition of the ship. Alternatively, 3D linear radiation-diffraction or non-linear strip theory codes can be used as input to SEAPEP.

Up to eight operational profiles are defined by their speed and heading. For each of the operational profiles the operational limits and their positions are defined by the maximum allowable displacements, velocities and/or accelerations. Furthermore, it is possible to specify operational limits of Motion Sickness Index (MSI), Motion Induced Interruptions (MII), relative wave elevations, etc.

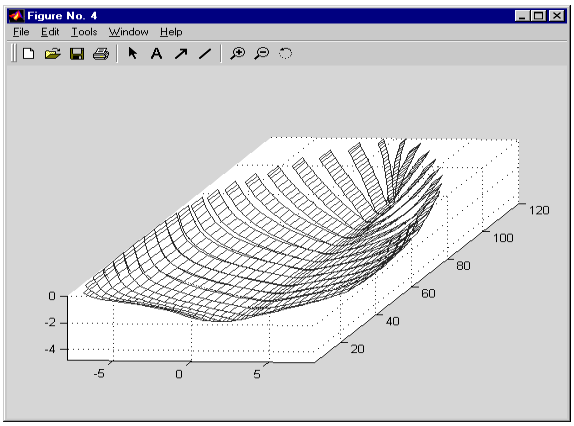
Based on the wave conditions in the wave scatter diagram and the specified operational profiles, SEAPEP calculates the motions and compares them with the operational limits.

Seakeeping tests for a large luxury yacht in FORCE Technology's towing tank

Seakeeping tests in large waves for OSV in FORCE Technology's towing tank



SEAPEP plot of operability within a wave scatter diagram



Definition of hull in SEAPEP

SEAPEP References

The SEAPEP program was originally developed for naval applications, and it has been validated with extensive model tests performed by FORCE Technology. The results show that the program is capable of ranking different design alternatives in the same order as model tests. The SEAPEP programme has also been used on a variety of commercial assignments with good results.

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