Calm water performances analysis

Because evaluation of hull performances in calm water condition is a critical stage in the design process of a vessel, SINTEF Ocean now offers a flexible package combining numerical and experimental approaches that allows verification and improvement of hull concepts. This fact sheet presents our vision of the timeline for this type of projects.

INITIATION PHASE

The Client contacts us when the first lines of the new hull design are being drafted. Our expert team can already provide feedback on the main hull features from a hydrodynamic point of view. An initial speed and powering analysis based on similar designs in our database is already drafted, in a unique opportunity to compare the vessel performances against a large range of other vessels, which is of vital importance for competitiveness of the new design.

INITIAL DESIGN ANALYSIS

Once the initial 3D hull design is available, numerical simulations using Computational Fluid Dynamics (CFD) are performed on the bare hull at design speed to get an insight in the flow features around the vessel. Wave and wake patterns, pressure distribution on the hull, and hull performances are used for further feedback on the hull design.

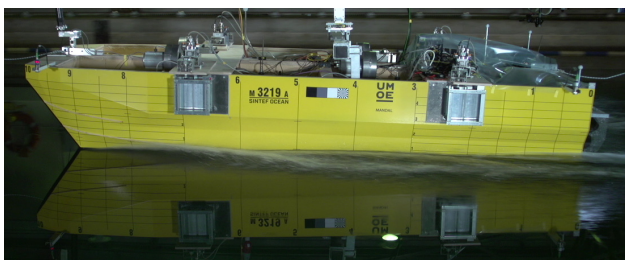

Figure 1 - Surface Effect Ship as Crew Transfer Vessel for Oil and Gas Market. Courtesy of UMOE Mandal AS

HULL LINES OPTIMIZATION

CFD simulations can then be repeated in a hull optimization process, verifying at each step that the modified features led to the desired improvement in performances. Usage of CFD tools allows extracting easily flow features, letting us detect subtle differences from one design to another or from one speed to another. In this process, the appendages can progressively be added to the hull as the Client gets a more precise idea of the final design of the vessel. The appendages can be positioned based on surface streamlines and information about the flow field obtained from the previous iteration. The added resistance due to each of the appendage is then monitored for a complete control on their effect on the vessel performances.

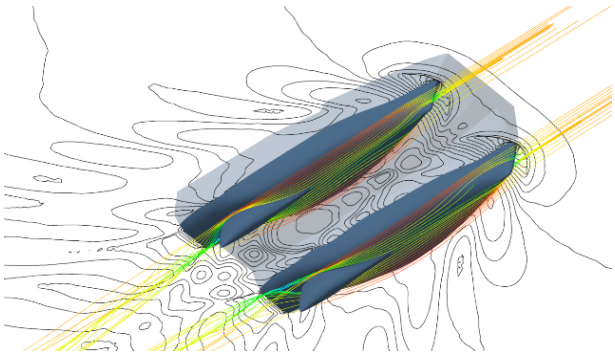

Figure 2 – Wave contours and streamlines under a catamaran design. Courtesy of Møre Maritime.

FINAL DESIGN ANALYSIS AND REPORTING

Once satisfied with the hull design performances, a model of the final hull design is build and tested in our facilities. The results from the latest CFD simulation are used to estimate the RPM at which the propulsion tests will be run.

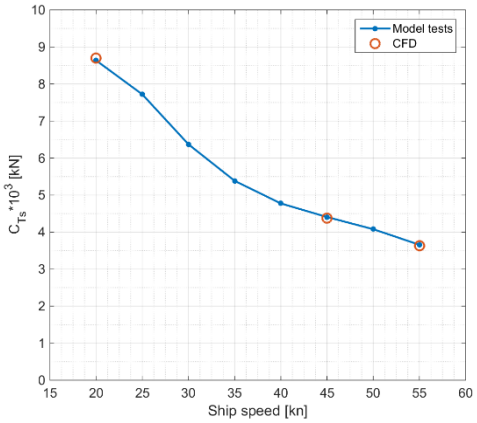

Figure 3 - Resistance curve of a high speed vessel, corrected for scaling effect, hull roughness and air drag. Comparison of model tests and CFD results. Courtesy of STM

REPORTING

The reporting progresses at each stage of the project. Results obtained from numerical and experimental investigations are post-processed in the same fashion in ShipX and are reported in an identical format, allowing the Client to compare easily different hull versions. In the final report of the project, the performances of the vessel are reported based on the latest evaluation, whether it has been made with CFD simulation or model tests. The streamlines and wake are however always obtained from full-scale CFD simulations in order to avoid scale effect on those results. Nominal wake can be extracted in multiple locations and for each computed speed. The tables obtained can be directly provided to propeller manufacturer.

SPEED AND POWERING PREDICTION

A final speed and powering prediction is issued based on the final decision for the propulsion arrangement of the vessel.

READY TO ORDER?

By ordering this type of project as a whole, the Client ensure entering a streamlined process to evaluate the calm water performances of his new hull designs, guaranteeing efficient timing of the project assisted by professional experts in ship hydrodynamics. External milestones can be considered as decision points to launch each of the project's phase.

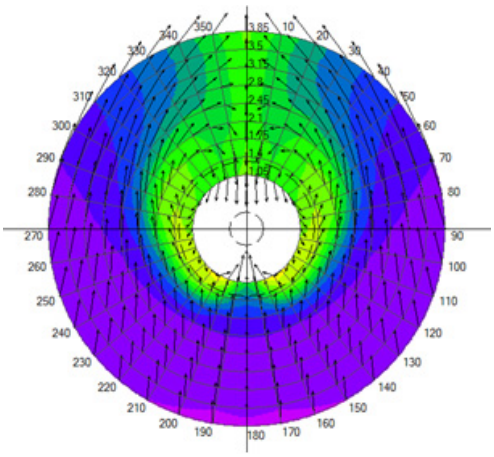

Figure 4 - Nominal wake in the propeller plane of a tanker vessel, obtained from full scale CFD simulations. Typically used for hull lines optimization and propeller design purposes. Courtesy of PROJEMAR

This approach suits all type of vessels: monohulls or multihulls, displacement or planning vessels, transport or service vessels.

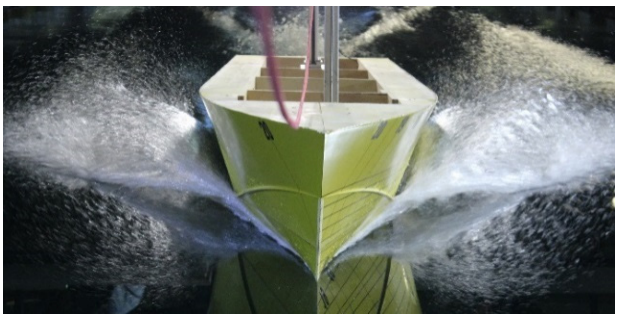

Figure 5 - Model tests of a planning hull on SINTEF Ocean's high speed test rig. Courtesy of STM

SINTEF

CONTACT:

Eloïse Croonenborghs
+47 926 78 061
Eloise.croonenborghs@sintef.no