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Resistance extrapolation for ships with a wetted transom stern

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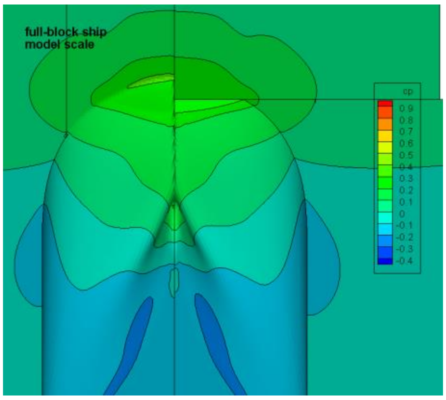
ABSTRACT

For predicting the speed-power performance of ships from model tests, the form factor approach is the ITTC-recommended method. There is a theoretical basis for the Reynolds-independence of the form factor for streamlined bodies without flow separation. Applying it to non-streamlined objects such as ships with immersed transom sterns, however, is doubtful.



Pressure distribution at the transom for an extended (left) and immersed (right) transom

Today, owing to the availability of CFD tools, such questions can be resolved. Recently the ITTC [1] gave high priority to the use of CFD and combined CFD/EFD methods for a more precise speed power prediction, with special emphasis on the scaling of transom flow and to update related Recommended Procedures. In our paper two methods will be considered to scale the resistance for partially wetted transoms

- The method used by MARIN since many years, in which the form factor is determined by double-body RANS computations for a hull smoothly extended at the transom. Then the computed form factor is usually equal for model and ship, which is one of the main assumptions in the recommended extrapolation procedures.
- A recent proposal from Chalmers University/SSPA (RISE) [2], in which the form factor is determined for the hull with immersed transom. They find that the form factor is larger for the model than for the ship, and both need to be computed separately; as an alternative, they have deduced an empirical formula for the difference.

In our paper, based on a number of RANS computations for a variety of vessels, at model and full scale, with and without extension at the transom, we will analyse and discuss the physical behaviour of the transom flow and its scale effects. We find that the underpressure at the transom, and the resulting transom drag coefficient, is often slightly larger at full scale than at model scale (but less pronounced than in [3]). We compare the behaviour of both methods in resistance extrapolation, and discuss the effect of the free surface and the practicality of the methods.

References

[1] The 2nd Specialist Committee on CFD and EFD combined methods. Final report and recommendations to the 30th ITTC.

[2] K.B. Korkmaz, S.Werner, R.Bensow. Scaling of wetted-transom resistance for improved full-scale ship performance predictions. In Ocean Engineering 266, 2022.

[3] A.R. Starke, H.C.Raven, A.P.van der Ploeg. Computation of transom-stern flows using a steady free-surface fitting RANS method. In 9th International Conference on Numerical Ship Hydrodynamics, Ann Arbor (Mi), USA, August 5-8, 2007.

[1] Retired from MARIN