# A Linearized Free-Surface RANS Method for Ship Maneuvering

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## ABSTRACT

Prediction of the maneuvering behaviour of a ship is an important task for the naval architect. Manevuering, together with powering, and seakeeping play an important role to help designers find and screen the optimal solution. All three of these tasks are well suited for analysis with Computational Fluid Dynamics (CFD). In the work detailed here a novel method based on a linearized free-surface RANS solver is used to assess maneuvering performance of both captive and free-running ship performance.

The linearized solver has been successfully employed for hull-form calm-water prediction [1] and has been recently extended to include a transient formulation to account for mesh motion and modelling maneuvering operations [2]. First, an earth-fixed coordinate system rigid body motion library was developed to simulate captive tests such as static drift, pure sway and pure yaw with unappended hull forms. The selected validation case is the well-know KCS hull and the results obtained for a series of tests are compared and validated against the experiments in terms of forces and moments response.

Recently the linearised RANS solver has been further developed to encompass a series of mesh motion methods to provide accurate and efficient simulations of free-running manevuering tests including zig-zag and turning circles including a transient dynamic rotation of the propellers and rudder in motion and results on different tests cases are presented.

The results achieved for both captive and free-running tests show that the proposed linearized free-surface RANS solver provides a viable cost-effective alternative to the traditional Volume-Of-Fluid (VOF) methods for a correct prediction of ship behaviour in the early stage of the design process.

## REFERENCES

[1] W. J. Rosemurgy, D. O. Edmund, K. J. Maki, and R. F. Beck "A Method for Resistance Prediction in the Design Environment", *11th International Conference on Fast Sea Transportation*, 2011.

[2] M. O. Woolliscroft *A Linearized Free-Surface Method for Prediction of Unsteady Ship Maneuvering*, PhD Thesis, University of Michigan, 2015.