

Open Water Propeller Performance

Project 2

Handed out: October 28

Due in: November 11

We will determine the performance of a propeller operating in open water. The propeller is a four-bladed stock propeller from the UM Marine Hydrodynamics Laboratory UM23. It is a four bladed propeller. An image is shown in figure 1. The propeller diameter is 0.158 m, and the $P/D = 1.08$.

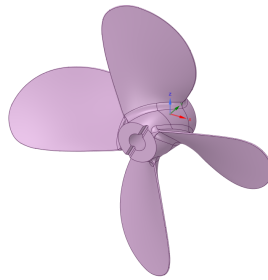


FIGURE 1. UM23 Propeller

A case is provided for you in the class github repository. Use the `pimpleFoam` solver for unsteady simulations. Compute the flow at three values of the advance coefficient, $J = 0.5, 0.7, 0.9$.

Perform a grid refinement study for $J = 0.7$. Thus you will have four total computations included in your results.

Your report is limited to 3 pages. Please be thorough in your write-up and use graphs judiciously. Formatting is very important to clearly communicate your results. Include the following components in your report:

Computational Setup: Discuss the solver that you used and the grid parameters like the total cell count and near-wall spacing (y^+). State the boundary conditions that you use on the inlet for the velocity and turbulence variables.

K_T , K_Q , and η_0 : Plot the thrust, torque, and efficiency and compare with the experimental data that is provided.

Flow Field: Plot the pressure on the front and back of the propeller for each of the three values of J . Show the velocity field and vortex structure for each value of J . See the paper [1] for inspiration on generating figures.

REFERENCES

- [1] R. Muscari, A. D. Mascio, R. Verzicco, Modelling of vortex dynamics in the wake of a marine propeller, *Computers & Fluids* (2012).