Study on the hydrodynamic performance of propellers in stratified environments with temperature and salinity gradients

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ABSTRACT

In the real oceanic environment, seawater exhibits stratification. The temperature, salinity, and density of seawater all vary with depth. Among these, temperature and salinity are the fundamental variables that jointly determine density and describe the basic properties of seawater. They have significant impacts on mixing, turbulence, vortices, and other phenomena, serving as crucial analytical indicators for conducting other marine research. This study considers the dual influence of temperature and salinity on density, simulating a linearly stratified flow field driven by both factors. Taking the MARIN 7371R propeller as the research object, numerical simulations and studies were conducted on its propeller performance in both homogeneous fluid and linearly stratified fluid influenced by the dual factors of temperature and salinity, yielding the propeller's hydrodynamic parameters. A comparison is drawn between stratified fluids and homogeneous fluids in terms of thrust coefficient, torque coefficient, and open water efficiency, highlighting the unique properties of stratified fluids. Furthermore, numerical simulations were conducted to evaluate the hydrodynamic performance of the MARIN 7371R propeller in various temperature-salinity fields. By comparing these three aspects of the propeller's performance, the impact of different temperature and salinity on the propeller's performance was discussed.

Keywords: Stratified Fluid; Propeller; Open water characteristics;

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