COMPARATIVE CFD STUDY FOR A SHIP HULL WITH SONAR DOME AT DIFFERENT POSITIONS

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SUMMARY

Sonar Domes are traditionally Hull Mounted and is placed in between bow and the mid ship. Placing the dome in such a way greatly reduces the risk of damage in heavy seas but it requires extreme design consideration. However, bow mounted domes also exhibit hydrodynamic advantages and are becoming more and more popular with time. A bow mounted dome may work like a bulbous bow and helps reducing the drag of the ship.

The position of the appended dome greatly influences the flow near the hull and greatly affects the performance of the hull. Since there is a scope to position the dome at various locations along the hull, a CFD analysis is done to determine the performance of hull at three different positions of the ship and the results are compared in this paper.

A detailed study of flow including streamlines, drag, wake at different regimes of flow etc., is made for different configurations of the dome. The sonar dome is placed at different locations beginning from the bow end to the mid-shipsection along the center-line of the ship and the performance of the hull is studied.

The surface model of the sonar dome with hull is generated using modeling package CATIA. Surface and volume mesh is generated thereafter using ICEM CFD (v 10.0). The mesh is imported for flow analysis into Fluent (v 6.2) software. RANS equation was solved for turbulent, viscous and steady flow. However, the free surface could not be resolved well with Fluent and hence wave-resistance could not be estimated with Fluent. SHIPFLOW software was used to get wave resistance. SHIPFLOW solves potential flow equations for estimating waves and predicts skin friction from boundary layer equations. The CHAPMAN solver of SHIPFLOW was also used to estimate the fully turbulent flow near the stern region. Whereas, the RANS solution of Fluent is expected to predict viscous resistance more accurately the wave resistance may be confidently predicted from potential flow solver of SHIPFLOW. Use of different flow-equations for estimating different components of ship-resistance is an interesting aspect of this paper. Finally the performances of ship hull with sonar dome at different positions are compared to obtain the best location.