

Numerical Investigation on Transitional Boundary Layer of Submarine with Different Bow Shapes

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The shape of a submarine bow affects the transition point of the boundary layer, and an excellent bow profile will delay the transition, thus improving the resistance performance, reducing hydrodynamic noise, which will benefit the stealth of the submarine. With the development of computational fluid dynamics (CFD), high-fidelity numerical simulation of transitional boundary layer near the bow is urgent, seeking to determine the best shape of the bow. First, the research status of boundary layer transition modeling methods is reviewed. Then, multi-block based structured grid and large eddy simulation (LES) are adopted to simulate the natural transition of different bow shapes. Vortex structures, transition point, skin friction, and pressure fluctuations are analyzed and compared. Finally, the best shape of submarine bow is chosen for subsequent research.

Keywords: Submarine; Transitional boundary layer; Bow shape; LES; CFD