Abstract Submitted
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A comparison of model-scale experimental measurements and computational predictions for a large transom-stern wave THOMAS T. O'SHEA, KRISTY L.C. BEALE, KYLE A. BRUCKER, DONALD C. WYATT, SAIC, DAVID DRAZEN, ANNE M. FULLERTON, TOM C. FU, NSWCCD, DOUGLAS G. DOMMERMUTH, SAIC — Numerical Flow Analysis (NFA) predictions of the flow around a transom-stern hull form are compared to laboratory measurements collected at NSWCCD. The simulations are two-phase, three-dimensional, and unsteady. Each required 1.15 billion grid cells and 200,000 CPU hours to accurately resolve the unsteady flow and obtain a sufficient statistical ensemble size. Two speeds, 7 and 8 knots, are compared. The 7 knots ($Fr = Uo/\sqrt{gLo} = 0.38$) case is a partially wetted transom condition and the 8 knots ($Fr = 0.43$) case is a dry transom condition. The results of a detailed comparison of the mean free surface elevation, surface roughness (RMS), and spectra of the breaking stern-waves, measured by Light Detection And Ranging (LiDAR) and Quantitative Visualization (QViz) sensors, are presented. All of the comparisons showed excellent agreement. The concept of height-function processing is introduced, and the application of this type of processing to the simulation data shows a $k^{-5/3}$ power law behavior for both the 7 and 8 knot cases. The simulations also showed that a multiphase shear layer forms in the rooster-tail region and that its thickness depends on the Froude number.

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