Prediction of cavitation over hydrofoil using RANS

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Abstract

This study presents a numerical investigation of cavitation over a NACA 0012 hydrofoil using the interPhaseChangeFoam solver in OpenFOAM. The hydrofoil, with a chord length of 0.1 m, is simulated in a C-type computational domain created in Gmsh. A two-phase homogeneous mixture model is employed along with the Schnerr & Sauer cavitation model to capture vapor formation and collapse. The k-ε turbulence model is used to resolve turbulent effects, and mesh refinement near the hydrofoil surface ensures accurate boundary layer resolution. Simulations are carried out for two cases: steady cavitation at 4° angle of attack and cavitation number $\sigma = 0.8$, and unsteady cloud cavitation at 7° angle of attack and $\sigma = 0.7$. The results reveal the initiation and development of cavitation from the leading edge, and the transition to cloud cavitation due to re-entrant jets.