The influence of nuclei content on cloud cavitation about a hydrofoil

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Abstract

The dynamics of cloud cavitation about a 3D hydrofoil are investigated experimentally in a cavitation tunnel for the bounding cases where the freestream is either deplete or with an abundance of nuclei. The hydrofoil has a rectangular planform with constant NACA 0015 section with a faired tip. The hydrofoil was tested at a Reynolds number of 1.4×10^6, a cavitation number of 0.55 and an incidence of 6° for both nuclei concentrations. High-speed photography of cavitation shedding phenomena was acquired simultaneous with unsteady force measurement to enable identification of cavity shedding modes corresponding with force spectral peaks. Two shedding modes are evident in the force spectra for both the nuclei deplete and abundant cases although each are driven by different flow phenomena in each case. The high mode for the nuclei deplete case is dominant driven by re-entrant jet formation during the growth phase but shockwave propagation for the collapse phase of the cycle. The weaker low mode is associated with local 3D shedding at the hydrofoil tip. The high mode remains strong at the same frequency for the nuclei abundant case despite changes in the shedding mechanisms whereas low mode is reinforced.

Keywords

Cavitation — Nucleation — Hydrofoils — Cavity dynamics

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