ISROMAC 2017
International Symposium on Transport Phenomena and Dynamics of Rotating Machinery
Maui, Hawaii
December 16-21, 2017

[Extended Abstract]

Cloud cavitation behaviour on a hydrofoil due to fluid-structure interaction

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Abstract

Despite recent extensive research into fluid-structure interaction (FSI) of cavitating hydrofoils there remains insufficient experimental data to explain many of these observed phenomena. The cloud cavitation behaviour around a hydrofoil due to the effect of FSI is investigated utilizing rigid and compliant 3D hydrofoils held in a cantilevered configuration in a cavitation tunnel. The hydrofoils have identical undeformed geometry of tapered planform with constant NACA0009 section. The rigid model is made of stainless steel and the compliant model of carbon and glass fibre reinforced epoxy resin with the structural fibres aligned along the span-wise direction to avoid material bend-twist coupling. Tests were conducted at an incidence of 6°, a mean chord based Reynolds Number of 0.7×10^6, and cavitation number of 0.8. Force measurements were simultaneously acquired with high-speed imaging to enable correlation of forces with tip bending deformations and cavity physics. Hydrofoil compliance was seen to dampen the higher frequency force fluctuations while showing strong correlation between normal force and tip deflection. The 3D nature of the flow field was seen to cause complex cavitation behaviour with two shedding modes observed on both models.