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Study of Cavitation Shedding Dynamics on a NACA0015 Hydrofoil Using X-Ray Densitometry[1] HARISH GANESH, JULIANA WU, STEVEN CECCIO, University of Michigan — Cavitation dynamics on the NACA0015 hydrofoil at several attack angles are found to be spectrally rich, being multi-modal with abrupt changes in Strouhal number with change in cavitation number. Present study focusses on identifying the physical mechanisms responsible for the change in cavitation dynamics on a NACA0015 hydrofoil in a re-circulating water tunnel using time resolved X-ray densitometry. Time-resolved void fraction flow fields obtained using X-ray densitometry, synchronized with acoustic noise measurements using a hydrophone, are used to identify different flow features and mechanisms that are responsible for the change in the observed spectral behavior. It is shown that under higher cavitation numbers, the shedding mechanism is predominantly re-entrant liquid flow based, but as the cavitation number drops many different processes are at play. At lower cavitation numbers, the shed cavity cloud collapse arrests cavity growth and this results in altered cycle dynamics and hence the Strouhal number. In addition, propagation bubbly shock waves are also found to be a dominant mechanism of shedding for certain conditions. The multi-modal nature of the acoustic pressure signature is explained by presence of different flow features, which could be concurrent or alternating.

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