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Tip vortex cavitation suppression by mass injection HARISH GANESH, University of Michigan, Ann Arbor, NATASHA CHANG, Naval Surface Warfare Center, Carderock Division, STEVEN CECCIO, University of Michigan, Ann Arbor — Injection of water and aqueous polymer solutions into the core of a trailing vortex is found to delay the onset of tip vortex cavitation (TVC). For the case without any mass injection, cavitation inception ($\sigma_I = 3.3$) occurred at a substantially higher pressure ($-C_{pmin} = 2.3$) than that was expected based on the mean vortical flow. Mass injection (both water and polymer) into the vortex core led to a reduction in the inception pressure. 2-D Particle Image Velocimetry was performed in a region of flow in the vicinity of the average inception location near the hydrofoil tip to determine the instantaneous flow fields near the vortex core. Mass injection led to significant modification of the unsteady flow field, while the average flow field was not strongly affected. A 50% reduction in RMS velocities in comparison with the non-injection conditions was observed for the case of polymer injection, the case of maximum cavitation suppression. Cavitation inception/desinence studies were conducted for different mass and momentum fluxes to develop a hypothesis for TVC suppression.

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