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Dynamics of Isolated Tip Vortex Cavitation[1] PEPIJN PENNINGS, Delft University of Technology, JOHAN BOSSCHERS, Maritime Research Institute Netherlands (MARIN), TOM VAN TERWISGA, Delft University of Technology — Performance of ship propellers and comfort levels in the surroundings are limited by various forms of cavitation. Amongst these forms tip vortex cavitation is one of the first appearing forms and is expected to be mainly responsible for the emission of broadband pressure fluctuations typically occurring between the 4th to the 7th blade passing frequency (approx. 40-70 Hz). These radiated pressure pulses are likely to excite parts of the hull structure resulting in a design compromise between efficiency and comfort. Insight is needed in the mechanism of acoustic emission from the oscillations by a tip vortex cavity. In the current experimental study the tip vortex cavity from a blade with an elliptic planform and sections based on $NACA\ 66_2 - 415$ with meanline $a = 0.8$ is observed using high speed shadowgraphy in combination with blade force and acoustic measurements. An analytic model describing three main cavity deformation modes is verified and used to explain the origin of a cavity eigenfrequency or "vortex singing" phenomenon observed by Maines and Arndt (1997) on the tip vortex cavity originating from the same blade. As no hydrodynamic sound originating from the tip vortex cavity was observed it is posed that a tip flow instability is essential for "vortex singing."

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