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Modeling Alternate Blade Cavitation in 2-Bladed Turbopump Inducers

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Abstract. This presentation will review the following topics. First, various local cavitation instabilities in turbopump inducers (e.g., alternate blade cavitation, super-synchronous rotating cavitation, etc.) which have been previously identified will be listed. Second, how tip leakage vortex cavitation on the leading blade affects incidence on the following blade in a 2-bladed inducer and how such effect varies with flow coefficient will be explained. Third, a new model to predict post-onset behavior of alternate blade cavitation instabilities will be presented. As the flow coefficient is decreased, the model predicts that 1) alternate blade cavitation occurs; and 2) the magnitude of alternate blade cavitation first increases, then decreases, and finally vanishes. Furthermore, simultaneous in-phase oscillations of the blade cavities are predicted during alternate blade cavitation. These in-phase oscillations of the cavities correspond to the surge mode oscillation, which had been previously mistakenly categorized as a global (system) instability.