Abstract Submitted
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Two-Phase Flow Model and Experimental Validation for Bubble Augmented Waterjet Propulsion Nozzle[1] J.-K. CHOI, C.-T. HSIAO, X. WU, S. SINGH, A. JAYAPRAKASH, G. CHAHINE, Dynaflow, Inc. — The concept of thrust augmentation through bubble injection into a waterjet has been the subject of many patents and publications over the past several decades, and there are simplified computational and experimental evidence of thrust increase. In this work, we present more rigorous numerical and experimental studies which aim at investigating two-phase water jet propulsion systems. The numerical model is based on a Lagrangian-Eulerian method, which considers the bubbly mixture flow both in the microscopic level where individual bubble dynamics are tracked and in the macroscopic level where bubbles are collectively described by the local void fraction of the mixture. DYNAFLOW's unsteady RANS solver, 3DYNAFS-VIS© is used to solve the macro level variable density mixture medium, and a fully unsteady two-way coupling between this and the bubble dynamics/tracking code 3DYNAFS-DSM© is utilized. Validation studies using measurements in a half 3-D experimental setup composed of divergent and convergent sections are presented. Visualization of the bubbles, PIV measurements of the flow, bubble size and behavior are observed, and the measured flow field data are used to validate the models. Thrust augmentation as high as 50% could be confirmed both by predictions and by experiments.

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