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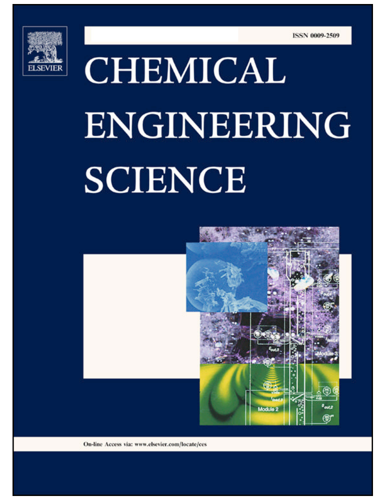

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Structure influence on jet pump operating limits

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Abstract

To increase the operating range for cavitating quantitative mixing devices, a new jet pump is proposed. The distribution of pressure, velocity, turbulent dissipation rate, and vapor bubbles were studied numerically, and the influence of geometric parameters and flow ratio on the operating range were investigated experimentally. The proposed jet pump overlaps the high turbulence and low pressure regions at the nozzle exit, causing significant cavitation. When the cross section near the diffuser inlet is filled with vapor bubbles, the jet pump reaches its operating limit. Since the structure of suction chamber remains the same as conventional jet pumps, increasing secondary flow deforms the axisymmetric cavity cloud, which leads to quick reduction of the critical pressure ratio. Empirical curves are proposed to optimize the area ratio for given flow ratios, based on experimental tests of nine jet pumps. When the critical flow ratio < 1.4% for a given optimal area ratio, the critical pressure ratio > 0.8, which is significantly higher than current jet pumps. Reliability of the proposed jet pump was examined when operating as quantitative mixing device and flow meter simultaneously. When the flow ratio < 4%, changes of area ratio, flow ratio, and viscosity of the working fluid have no effect flow rate measurement accuracy, and flow rate error < 3.32% under all test conditions.

Keywords: Cavitation, Jet pump, Critical pressure ratio, Flow ratio, Flow meter