A Cavitating Device for Mini Quantitative Liquid Addition

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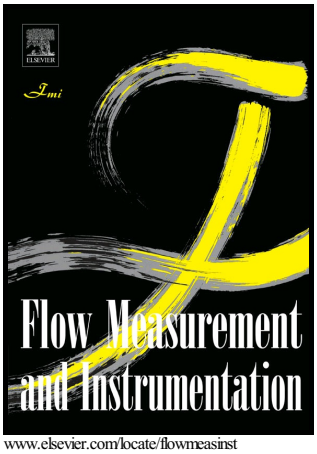

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Abstract

To improve accuracy and stability of mini quantitative liquid adding, a new cavitating venturi device is proposed and investigated experimentally. Cavity cloud initiates at the throat exit where the velocity gradient is the highest and the local pressure is the lowest. Since the suction inlet is set at the throat exit, it is easily covered by the cavity cloud in which the pressure remains at saturation vapor pressure. Once cavity cloud dominates the suction inlet, both working and suction flow rate remains constant and independent of downstream pressure. Therefore, the proposed device can be used as an adding device and a flow meter simultaneously when it is under cavitation condition. The critical pressure ratio exceeds 0.6 when flow ratio is below 2%, which is over 50% higher than present jet pumps. The critical pressure ratio rises with the decreasing of adding ratio, which makes the proposed adding device especially applicable for mini quantitative adding. Moreover, the working range of the proposed device is hardly changed when sucked water is replaced by high-viscosity foaming agent.

Keywords: Cavitation; Mini quantitative adding; Venturi; Flow ratio; Critical pressure ratio

Nomenclature and symbols

d_t throat diameter, mm
L_t throat length, mm
p_i inlet pressure, Pa
p_o outlet pressure, Pa
$p_{i,t}$ throat inlet pressure, Pa;
$p_{m,t}$ middle throat pressure, Pa
$p_{e,t}$ throat exit pressure, Pa
$p_{0,t}$ stagnation pressure at the throat, Pa
p_v saturation water vapor pressure of water, Pa
$p_{i,abs}$ absolute inlet pressure, Pa
$p_{o,abs}$ absolute outlet pressure, Pa
p' fluctuating pressure, Pa
$\bar{p}$ time averaged pressure, Pa
v_i inlet velocity, m/s