Effects of Nozzle Geometry on the Near-field Characteristics of a Liquid Jet

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Abstract

Due to the significant impact of jet breakup phenomena with regards to modern industrial applications, and the present lack of its complete understanding, it is important to fully investigate liquid jets and their relationship to nozzle geometry [1]. This objective can be fulfilled by gaining a better understanding of the relationship between nozzle geometrical parameters and jet behaviour, such as velocity and turbulence intensity profiles, discharge coefficient, surface properties, and breakup of the ensuing jet. The present paper reports an experimental investigation of the effect of nozzle geometry on the near-field characteristics of a liquid jet discharging into a still environment at standard ambient conditions. The influence of nozzle geometry on jet flow is studied here by examining nozzle aspect ratio and angle of contraction. Liquid jet mean-velocity and turbulence intensity profiles as well as surface appearance are reported in order to analyze the effects of these geometric nozzle parameters. The experimental results revealed that decreasing the nozzle aspect ratio generally flattens the velocity profiles, thus generating a less turbulent jet. Decreasing the contraction ratio tends to increase the level of turbulence. Also, increasing nozzle diameter appears to promote turbulence. The present study ultimately shed more light on the irrefutable relationship between nozzle geometry and the nature of the ensuing liquid jet.
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Key words: Jet, Nozzle, Geometry, Spray, Break-up

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