

Comparative Analysis of Turbulent Plane Jets from a Sharp-Edged Orifice, a Beveled-Edge Orifice and a Radially Contoured Nozzle

Authors : Ravinesh C. Deo

Abstract : This article investigates through experiments the flow characteristics of plane jets from sharp-edged orifice-plate, beveled-edge and radially contoured nozzle. The first two configurations exhibit saddle-backed velocity profiles while the third shows a top-hat. A vena contracta is found for the jet emanating from orifice at $x/h = 3$ while the contoured case displays a potential core extending to the range $x/h = 5$. A spurt in jet pressure on the centerline supports vena contracta for the orifice-jet. Momentum thicknesses and integral length scales elongate linearly with x although the growth of the shear-layer and large-scale eddies for the orifice are greater than the contoured case. The near-field spectrum exhibits higher frequency of the primary eddies that concur with enhanced turbulence intensity. Importantly, highly "turbulent" state of the orifice-jet prevails in the far-field where the spectra confirm more energetic secondary eddies associated with greater flapping amplitude of the orifice-jet.

Keywords : orifice, beveled-edge-orifice, radially contoured nozzle, plane jets

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020