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The Role of Nozzle-Exit Conditions on the Flow Field of a Plane Jet

Authors : Ravinesh C. Deo

Abstract : This article reviews the role of nozzle-exit conditions on the flow field of a plane jet. The jet issuing from a sharp-edged orifice plate at a Reynolds number (Re=18000) with nozzle aspect ratio (AR=72) exhibits the greatest shear-layer instabilities, highest entrainment and jet-spreading rates compared to the radially contoured nozzle. The growth rate of the shear-layer is the highest for the orifice-jet although this property could be amplified for larger Re or AR. A local peak in turbulent energy is found at x=10h. The peak appears to be elevated for an orifice-jet with lower Re or AR. The far-field energy sustained by the orifice-jet exceeds the contoured case although a higher Re and AR may enhance this value. The spectra displays the largest eddies generated by the contoured nozzle. However, the frequency of coherent eddies is higher for the orifice-jet, with a larger magnitude achievable for lower Re and AR.

Keywords : plane jet, Reynolds number, nozzle-exit conditions, nozzle geometry, aspect ratio
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