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REVIEW AND SOME RESEARCH RESULTS ON JET FLOW CHARACTERISTICS

M. A. T. Ali

Department of Mechanical Engineering,
Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

ABSTRACT

Jet is a common flow situation occurred both in nature and in engineering installations. It is also a simple flow to study and to understand the basic characteristics of flow, particularly its mixing process. In this paper review of some of the works on jet flow is presented and some research findings on the effect of different flow conditions like upstream flow excitation, wedge shape nozzle exit, vertical flange at the nozzle discharge, spline shape nozzle surface, upstream swirl and coaxial jets, without and with trip ring excitation are discussed. In all the cases measurements were taken in the Reynolds number range Rd = 2 x 10^4 to 1 x 10^5. For each case axial mean velocity and static pressure were measured by pitot-static probe and axial turbulence intensity by constant temperature hot-wire anemometer. For the jets in general, the mean static pressure within the potential core was positive and that in the mixing region was negative. The decay of centerline mean velocity was maximum at the preferred mode of excitation and was minimum at the suppression mode. Near the exit, the streamwise mean velocity profiles were saddle shaped which disappeared at the end of the potential core. Turbulence intensity was enhanced in presence of vertical flange, wedge shape exit and splined nozzle surface. The central line turbulence intensity decreased due to the presence of vertical flange and wedge angle. But for upstream excitation the centerline turbulence intensity increased with increase of excitation frequency, reached its maximum value at Std = 0.58 and with further increase of excitation frequency it started to decrease and reached its minimum value at Std = 1.8. In the case of helical swirling jet, there was no existence of potential core due to intense mixing which was completed within two diameter down-stream from the nozzle exit. In the case of coaxial jets two distinct mixing zones, one between the central jet

and inner boundary of the annular jet and the other between the outer boundary of the annular jet and the surrounding air, existed in coaxial jets. Potential cores of these jets were longer (6d) than that of the single jet (5d). After nine diameters downstream the two jets merged together and behaved like a single jet for the area ratio 3.57 but this value increased with the increase of area ratio. For trip ring excited coaxial jets the effect of inner trip ring excitation in mixing two jets was more prominent than the outer one.

Keywords: Preferred Mode, Suppression Mode, Trip Ring.