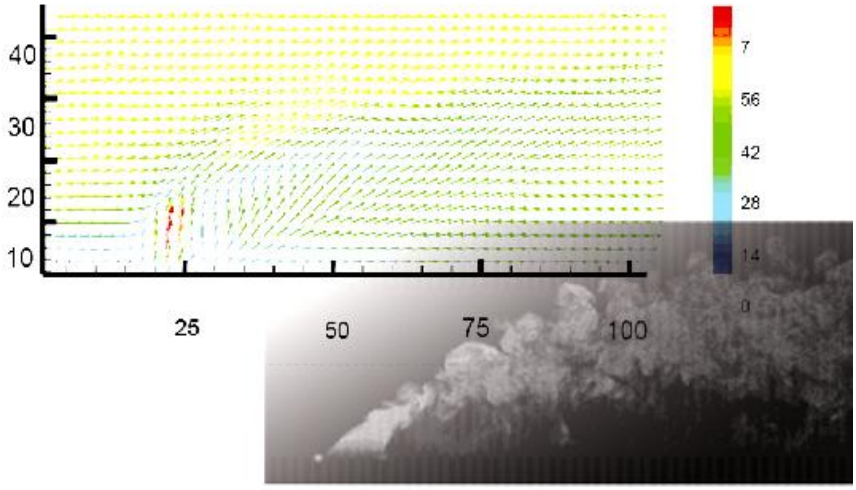
EXPERIMENTAL STUDY ON THE FLOW CHARACTERISTICS OF STREAMWISE INCLINED JET IN CROSSFLOW

APPLICATION NOTE PIV-013



The introduction of a jet of fluid transversely into a moving stream is a basic configuration which finds application in many engineering fields. Examples include vertical takeoff and landing engineering, film cooling of gas turbine blades and environmental problems such as pollutant dispersion from chimneys or the discharge of effluents into the ocean. Enhancement of the mixing rate between jet and crossflow can lead to significant improvements in many performance aspects. Because of the great practical significance, numerous experimental and theoretical studies have been carried out on the jet -in-a-crossflow problem.
An experimental investigation was carried out to study the structure of the flow field resulting from the interaction of an inclined round jet with a cross flow. The study of the flow field was conducted in a wind tunnel test by means of PIV system. The jet being discharged with a 60° angle, the resulting flow has been found to be quite complex owing to its three-dimensional nature and the interactions between several flow regions.

The Particle Image Velocimetry system is based upon a TSI PowerView™ system, including a 50 mJ dual YAG laser, a PowerView™ 4MP high resolution cross-correlation camera (2 k × 2 k resolution, 12 bits), a synchronizer and *INSIGHT* 3G™ Windows® XP-based software for acquisition, processing and post-processing. This software allows the synchronization of pulsations according to the observed phenomena, and the adjustment of the time step between two images. This time step was 70 µs.

The effect of the jet inclination angle on various flow structures was examined. Results were quantified in terms of the ratio of the mean jet velocity and the free stream velocity of the cross-flow. The properties of the Kelvin-Helmholtz vortex structures, such as the patterns rotational direction, were strongly dependent on this ratio.

Reference

Mahjoub Said, N., Stefanini, J., Bournot, P., Darreau, S., Caminat, P., “Experimental study on the flow characteristics of streamwise inclined jet in crossflow,” *13th Int. Symp. on Appl. Laser Techniques to Fluid Mechanics,* Lisbon, Portugal, June 26–29, 2006.

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