

Numerical Investigation of a Slightly Oblique Round Jet Flowing into a Uniform Counterflow Stream

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Abstract : A counterflowing jet is a particular configuration of turbulent jets issuing into a moving ambient which has not carried much attention in literature compared with jet in a coflow or in a crossflow. This is due to the marked instability of the jet in a counterflow coupled with experimental and theoretical difficulties related to the flow inversion phenomenon. Nevertheless, jets in a counterflow are encountered in many engineering applications which required enhanced mixing as combustion, process and environmental engineering. In this work, we propose to investigate a round turbulent jet flowing into a uniform counterflow stream through a numerical approach. A hydrodynamic and thermal study of a slightly oblique round jets issuing into a uniform counterflow stream is carried out for different jet-to-counterflow velocity ratios ranging between 3.1 and 15. It is found that even a slight inclination of the jet in the vertical direction of the flow affects the structure and the velocity field of the counterflowing jet. In addition, the evolution of passive scalar temperature and pertinent length scales are presented at various velocity ratios, confirming that the flow is sensitive to directional perturbations.

Keywords : jet, counterflow, velocity, temperature, jet inclination

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