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Cross-Plane Near-Field Turbulence Structure of Swirling Jets
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Swirling jets are used in several industrial applications and are interesting from a fundamental view of turbulence. It has been shown that, as swirl increases past a threshold value, the single-point statistics in the jet significantly change suggesting changes in turbulence structure. To test this assumption, Stereoscopic Particle Image Velocimetry (SPIV) is applied to measure instantaneous velocity in cross-planes (the radial-azimuthal planes). Proper Orthogonal Decomposition (POD) is then applied to these measurements to identify large scale turbulence structure. The POD results allow for comparisons in structure to be made between non-swirling jets and swirling jets. POD results were previously obtained using measurements in the axial-radial plane of the near field, and a significant reordering in modal dominance was observed. In the present study, the measurements in the radial-azimuthal plane are axisymmetric, and the POD analysis takes advantage of the homogeneity in the azimuthal direction. Results obtained at several different axial locations are considered in order to understand how the turbulence structures develop and evolve in the near field.

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