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Modal Decomposition of Single- and Double-Pulsed Unsteady Jets ZHENG ZHANG, DHUREE SETH, SRAVAN ARTHAM, GORDON LEISHMAN, EBENEZER GNANAMANICKAM, Embry-Riddle Aeronautical University
— This study focused on the differences in the evolution of turbulent puffs, where two puffs separated by a short time interval (double-pulsed jet) are ejected from a circular nozzle into quiescent air. The Re based on the jet exit velocity (V_j) and nozzle diameter (d) was 1,500. The interval between the puffs varied from $\delta t V_j/d =$ 225 to 787. The evolution of near jet exit flow field ($\leq 17d$) was measured using a time-resolved PIV system. Proper orthogonal decomposition (POD) and dynamic mode decomposition (DMD) were used to analysis the unsteady flow modes, as well as their spatial and temporal evolution. There were considerable differences in the coherent structure of the starting vortex for the second ejection because of wakened shear layer in the first ejection wake. These differences were observed from the POD energy distribution. The Ritz value of the dynamic modes indicated that the double-pulsed jet system is more stable than the single-pulsed jet. The stability of the double-pulsed jet increased with decreasing time interval between the ejections. A combination of the increase in momentum flux and the turbulent wake of the first ejection was found to stabilize the flow field of the second ejection.

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