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Vortex Dynamics of Pitched Orifice Synthetic Jets in Quiescent Fluid JOHN FARNSWORTH, MATTHEW KNICKERBOCKER, JOSEPH STRACCIA, University of Colorado, Boulder — The influence that the orifice pitch angle and downstream lip radius have on the vortex dynamics of an aspect ratio, $AR = 20$, rectangular synthetic jet actuator issuing into quiescent fluid are investigated experimentally using particle image velocimetry measurements. Comparisons are made for an orifice pitch angle of $\alpha = 45°$ and dimensionless downstream lip radii of $R^* = 0$, 5.1, and 7.8 at conditions of $Re = 910$ with $St = 0.097$. The time- and phase-averaged velocity fields were recorded on the centerline of the orifice major axis in addition to two off-centerline spanwise positions. Analysis of the phase-averaged vorticity field showed that the vortex formation is strongly influenced by the lip radius, which noticeably alters the flow field development. Specifically, increasing the downstream lip radius increases the asymmetry in the strength of the elongated vortex that is formed. This in turn increases the momentum near the wall aligned in the direction tangential to the wall. Additionally, all geometries exhibited a highly three-dimensional jet development which is the result of vortex dynamics associated with: 1) spatial variability in self-induction, 2) circulation asymmetry, and 3) possibly interactions with the wall image vortex system.

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