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Estimation of Turbulent Wall Jet Velocity Fields for Noise Prediction ADAM NICKELS, LAWRENCE UKEILEY, University of Florida, ROBERT REGER, LOUIS CATTAFESTA, Florida State University — Estimation of the time-dependent turbulent velocity field of a planar wall jet based on discrete surface pressure measurements is performed using stochastic estimation in both the time and frequency domain. Temporally-resolved surface pressure measurements are measured simultaneously with planar Particle Image Velocimetry (PIV) snapshots, obtained at a relatively reduced rate. Proper Orthogonal Decomposition (POD) is then applied to both the surface pressure probes and the PIV snapshots, allowing for the isolation of portions of the wall pressure and velocity field signals that are well correlated. Using the time-varying pressure expansion coefficients as unconditional variables, velocity expansion coefficients are estimated and used to produce reconstructed estimates of the velocity field. Optimization in terms of number of unconditional probes employed, location of probes, and effects of PIV discretization are investigated with regards to the resulting estimates. Coupled with this analysis, Poisson's equation for fluctuating pressure is solved such that the necessary source terms of an acoustic analogy can be calculated for estimates of the far-field acoustics. Specifically in this work, the effects of using estimated velocity fields to solve for the hydrodynamic pressure and acoustic pressure will be studied.

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