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Low-order Description and Conditional Averaging in a Transitional Variable-Density Jet[1] BIANCA VIGGIANO, TAMARA DIB, NASEEM ALI, Portland State University, LARRY MASTIN, US Geological Survey, STEPHEN SOLOVITZ, Washington State University - Vancouver, RAUL BAYOAN CAL, Portland State University — A vertically oriented jet is investigated using particle image velocimetry to identify characteristics of the flow that contribute to the distribution of turbulent kinetic energy and development of Reynolds shear stresses. Experiments with three different gases air, argon and helium— as the jet and a range of exit velocities were performed to allow for variety of the Reynolds and Richardson numbers. Five cases are examined in total. Proper orthogonal decomposition is applied to assess the energy distribution of all cases with respect to the number of modes. Reconstruction of the Reynolds shear stresses using 50% of the total turbulent kinetic energy is performed. Quadrant analysis with respect to the Reynolds shear stress is also performed for insight into the entrainment of the jet. Reynolds shear stresses are dominant in Q1 - advancing ejections and Q3 - impeding entrainment and exhibit negligible contributions from the remaining two quadrants. POD is able to identify most dominant structures and transition effects within the basis. Via quadrant analysis, advancing ejection and impeding entrainment further describe the streamwise development of each jet.

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