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Evaluation of Similarity Theory for Weakly Swirling Jets using LDA Measurements RICHARD SEMAAN, Univeristy of Wyoming, JONATHAN NAUGHTON, University of Wyoming — A similarity theory for weakly swirling jets developed by Ewing in 1999 is considered using recent experimental measurements. Momentum conserving jets with swirl numbers varying from 0 to 0.4 were measured using 3-D Laser Doppler Anemometry. This range ensured that none of the jets exhibited vortex breakdown. High quality measurements of the mean velocities and Reynolds stresses allow for a comprehensive evaluation of the theory. Despite the rapid decay of the swirl velocity relative to the axial velocity, the jet behavior is shown to be consistent with Ewing's theory even in the limited axial region where the swirl velocity is still significant. This is demonstrated through use of the experimental data to consider the constraints that are required for and the scaling quantities that result from the development of the similarity theory. The similarity theory governing weakly swirling jets is shown to hold for a range swirl numbers and thus provides another canonical flow for validating models. This theory is particularly useful for validating models that attempt to capture curvature effects.

Jonathan Naughton
University of Wyoming

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