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**Mean dynamics of a turbulent plane wall jet** FARAZ MEHDI, Hypertherm Inc., JOSEPH KLEWICKI, University of New Hampshire, University of Melbourne — Experimental and large-eddy simulation data are used to investigate the balances between viscous and inertial forces in plane turbulent wall jets. In recent years, analysis of the mean momentum balance in its unintegrated form has been shown to provide a mathematically and physically useful means for clarifying the leading order mean dynamics as a function of the transverse coordinate. Distinct from its laminar counterpart, each of the terms in the appropriately simplified form of the mean dynamical equation for the planar turbulent wall jet is leading order somewhere, but not everywhere, across the flow domain. Similar to what is observed in the canonical turbulent wall-flows, there is a wall region where the mean viscous force retains leading order. The wall jet, however, contains two peaks of opposite sign in its Reynolds stress profile. With distance from the wall, the first peak is associated with the loss of a leading order viscous force, while the outer peak is akin to the wholly inertial balance exchange that occurs in shear-wake flows. The physics of these balances exchanges are described, the scaling behaviors of the leading order balance layers are estimated, and the present findings are compared with previous models of planar wall jet structure.

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