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Effect of Various Parameters on Evolution of 2D Free Jets and their Associated Entrainment Rates[1] MAZYAR AMIN, DANA DABIRI, University of Washington, HOMAYUN NAVAZ, Kettering University — Refrigerated vertical display cases are extensively used in supermarkets and grocery stores. Cold air is supplied vertically across the open face of the display case from the top, creating a cold air curtain acting as a barrier to separate the cold air within the case from the warm ambient air. Typically, 70-80% of the load on these vertical display cases is due to cooling of infiltrated warm ambient air. Our goal is to understand parameters affecting warm air infiltration into the case so as to minimize the cooling load. Towards this end, steady state behavior of 2D vertical air jets at Reynolds numbers 2,000 to 10,000 with low and high turbulence intensities (0% &10%) at the nozzle exit are experimentally and computationally investigated both within a quiescent ambient and next to an open cavity. Four different velocity profile shapes (top-hat, parabola, skewed parabola and linear) at the jet exit are also studied to determine profile effects on the evolution of and entrainment into the jet. Results will be presented to show the effect of these parameters on the total entrainment into the jet, as well as the variation of entrainment across the jet at different downstream locations. The results of this work can help better understand how to design air curtains as a buffer to minimize infiltration into open refrigerated vertical display cases.

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