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Scaling Analysis of Temperature Variability Between a Rotating Cylinder and a Turbulent Buoyant Jet CAELAN LAPOINTE, NICHOLAS T. WIMER, TORREY R.S. HAYDEN, JASON D. CHRISTOPHER, GREGORY B. RIEKER, PETER E. HAMLINGTON, University of Colorado, Boulder — Vortex shedding from a cylinder is a canonical problem in fluid dynamics and is a phenomenon whose behavior is well documented for a wide range of Reynolds numbers. Industrial processes, by contrast, often have many moving parts that may also be exposed to high temperatures, resulting in highly complex flow fields. This complexity can, in turn, introduce velocity and temperature variations that may be undesirable for a particular industrial process. In this study, we specifically seek to understand and parameterize temperature variability between a rotating cylinder and a high-temperature turbulent buoyant jet. The relevance of this configuration for industrial processing is outlined, and velocity and temperature fields between the jet and cylinder are obtained using large eddy simulations (LES). In the LES, key parameters such as the angular velocity and diameter of the cylinder, the dimensions, velocity, and temperature of the turbulent buoyant jet, and the distance between the cylinder and the jet are varied. The resulting LES results are then used to develop scaling relationships between temperature variance near the cylinder and other problem parameters. Such scaling relations will be highly beneficial for the estimation of temperature variations in industrial applications.

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