Abstract Submitted
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Wire-cooling based synthetic experiment to evaluate multi-sensor hotwire performance[1] SPENCER ZIMMERMAN, CALEB MORRILL-WINTER, University of Melbourne, JOSEPH KLEWICKI, University of Melbourne, University of New Hampshire — Representation of the Navier-Stokes equations in vorticity form elucidates the importance of vorticity in transporting momentum in turbulent flows. While hotwire sensors have been previously employed to measure multiple components of velocity and vorticity simultaneously, physical limitations inhibit the resolution of ever-smaller dynamically relevant motions, and thus cap the range of measurable Reynolds numbers in a given facility. Cross-stream velocity measurement arrays are also susceptible to error caused by non-uniform flow between array elements. The goal is therefore to minimize the sensing area of the probe while maintaining a wire orientation that will effectively recover the desired signals. We present a wire arrangement aimed at measuring all three components of vorticity about a common point. The turbulent boundary layer DNS of Sillero (*Phys. Fluids* **25**, 2013) is utilized to generate synthetic results from the proposed orientation. Effective cooling velocities are calculated at interrogation nodes corresponding to wire locations. Subsequent recovery of velocity components from cooling velocities incorporates inter-array gradient error into the results. The sensor geometries that best reproduce the known vorticity signals are described and discussed.

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