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The spatial resolution of velocity and velocity gradient turbulence statistics measured with multi-sensor hot-wire probes P. VUKOSLAVČEVIĆ, Univ. of Montenegro, N. BERATLIS, E. BALARAS, J.M. WALLACE, Univ. of Maryland — A highly resolved turbulent channel flow DNS with $Re_{\tau} = 180$ was used to investigate the effects of the spatial resolution of a twelve-sensor hot-wire probe on measurements of velocity and velocity gradient based statistics. Sensor array separations varying from $S^+ = 2$ to 12 (Kolmogorov lengths $\eta = 1$ to 6 at $y^+ = 15$) have been examined, where the sensors were represented as points on the simulation grid. The effective velocity cooling each sensor was determined, and the sensor equations were then solved in response to the DNS flow field to obtain the velocity and velocity gradient components for two cases. These were: 1) an idealized probe where the influence of the velocity component tangential to the sensors and flow blockage by the presence of the probe are neglected and (2) a real probe, the calibration coefficients of which have been determined experimentally. The resolution effects on the statistics obtained from the ideal and real probes are quite similar. These effects are greatest for the v velocity and ω_z vorticity components. For $S^+ = 8$ ($\eta = 4$ at $y^+ = 15$), the rms peaks of these components are attenuated by about 8% and 15%, respectively. Their skewness and flatness factors are also strongly affected. PDFs and k_x spectra of the velocity and vorticity components will be discussed to explain these effects.

> James M. Wallace University of Maryland

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