Abstract Submitted
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Revisiting George, 1978: When are velocity samples independent? BARTON SMITH, Utah State University — It is well known that the standard deviation of the mean of a sample is the standard deviation of the parent population divided by the square root of the number of samples, assuming the samples are independent. In 1978, William George [1] suggested that the sampling period must be greater than two integral time scales T_u to ensure independent samples in turbulent flow. This time scale is defined as the integral over all time of the autocorrelation of the velocity signal. In the present work the velocity in a turbulent rectangular incompressible jet was measured using a single calibrated hot-wire probe with sampling periods above and below 2 T_u. To determine T_u, 11 sets of 100,000 data points were acquired at high rate. Each set was divided into 50 records of 2000 points. The autocorrelation ρ, was computed for each record, and the 550 results were averaged together. T_u was computed by integrating ρ form 0 to the time where ρ became negative. Returning to the same flow, data were acquired at rates above and below those recommended by George. It is found that even at 8 times the rate recommended by George, the mean converged at a rate of 1/sqrt(N) [although the error was larger than S/sqrt(N)] and that at sampling period of $2T_u$ the error in the mean was well predicted by S/sqrt(N). However, sampling slower resulted in a smaller mean error.

[1] William K. George Jr. Processing of random signals. In *The Dynamic Flow Conference* 1978 on Dynamic Measurements in Unsteady Flows, pages 757–800, 1978.

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