Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Computing Confidence Limits on Experimental Data from the Distribution of Synthetic Data Sets[1] ROBERT DOWNS, EDWARD WHITE, Texas A&M University — Multicomponent velocity measurements were obtained in a flat plate boundary layer downstream of cylindrical roughness elements using hotwire anemometry. In this configuration, the spanwise velocity (computed indirectly from the hotwire measurements) is small compared to the streamwise velocity. As a result, random and systematic errors can potentially bring about large errors in this quantity. Confidence limits are placed on the previously reported results of this experiment using Monte Carlo simulation of synthetic data sets. By introducing random perturbations to the uncertainties in estimated parameters (such as hotwire calibration coefficients), synthetic realizations of the experimental data are generated. The distribution of these realizations around the results of the actual experimental data is used to determine the level of confidence with which the experimental results are known. This technique includes the effects of covariance among different groups of uncertain parameters; as these covariances are not explicitly known the standard methods of error propagation cannot be used to accurately quantify the uncertainty of the experimental results. Finally, a quantitative comparison is made between experimental and DNS results in light of these confidence limits.

[1]Supported by AFOSR under grant FA9550-07-1-0312

Robert Downs
Texas A&M University

Date submitted: 01 Aug 2008 Electronic form version 1.4