ME 5700/6700 – Intermediate Fluid Mechanics Fall 2007
Turbulent Boundary Layer Laboratory
Due December 10, 2007

Purpose

The purpose of this laboratory is to gain physical insight into the theoretical presentation of turbulent boundary layers given in class and to help compare and contrast the differences between turbulent and laminar boundary layers. This is a follow-up to the laminar boundary layer laboratory. 6700 students will do this lab individually and 5700 students may do the lab small groups (up to 3).

Requirements

Each student will hand in a document meeting the following requirements and answering the questions below.

1. Hand in a complete set of note pages with hand calculations and observation made during the experiment.
2. Using the voltage time series provided, the handout from the previous lab and the new A, B and n values given to you from the TA, calculate the time series of the velocity. On a single axis plot the time series of the freestream flow and a point within the boundary layer. Note any differences.
3. For the same Re_x, plot the non-dimension velocity profiles for both laminar and turbulent flow data on a single axis (i.e. y/δ_{99} vs. $\bar{u}/U_\infty$). Please compare and contrast the two.
4. Plot the non-dimension turbulence intensity profile relative to the freestream mean velocity (i.e. y/δ_{99} vs. σ_u/U_∞). Please comment on the physical meaning of the shape of this curve.