

Date: October 6th 2006

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Dr. Luciano Castillo
Rensselaer Polytechnic Institute

Title: “Application of the Equilibrium Similarity in Pressure Gradient Turbulent Boundary Layers”

Abstract

Similarity analysis and near asymptotic methods have been used to investigate the turbulent boundary layer with roughness surface and pressure gradient flow including accelerating and decelerating boundary layers. The application of the equilibrium similarity on the equations of motion can not only help us obtaining the scales for the velocity field including the temporal and spatial scales but it can yield constraints necessary to characterize pressure gradient flows including non-equilibrium adverse pressure gradient flows. In this seminar examples of this method will be used to design experiments on smooth/rough surfaces particularly in calculating wall shear stresses. Furthermore, this technique will be shown to be applicable for generating inflow fluctuations in turbulent boundary layers for Large Eddy Simulations primarily on adverse pressure gradient boundary layers and thermal boundary layers.

Moreover, the power law solutions for ZPG from George & Castillo (1997) via the near asymptotic approach will be extended for rough surfaces subject to pressure gradient. From these solutions a new composite profile is found for the roughness boundary layer and adverse pressure gradient boundary layer, respectively. The new skin friction law in the power law form and other boundary layer parameters are investigated. Meanwhile, different measurements have been performed including Adverse Pressure Gradient (APG) and Favorable Pressure Gradient (FPG) turbulent boundary layer with variable initial conditions. Through this investigation, the effects of the roughness on the boundary layer have been investigated carefully on the inner and outer flow.