



MMAE SEMINAR

WEDNESDAY, November 16, 2005
E-1 BUILDING – CRAWFORD AUDITORIUM
3:30 – 4:30 PM

What Streamwise Curvature does to Relaminarization in a Favorable Pressure Gradient

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We report here the results of experiments on two flows, one on a convex and the other on a flat surface, designed to bring out explicitly the influence of curvature on relaminarization in highly favourable pressure gradients. In both flows the initial conditions and the streamwise distribution of the pressure gradient parameter K are virtually identical. The maximum value of K in both flows is 6.2×10^{-6} , well above the usually accepted critical value of about 3.5×10^{-6} , and the spatial extent of the acceleration is about 11 initial boundary layer thicknesses. It is found that the degree of relaminarization is appreciably higher and more rapid on the convex surface compared to the flat surface, as indicated by a steeper fall in the skin friction coefficient and a sharper rise in the shape factor. The quasi-laminar theory of Narasimha & Sreenivasan (1973) (without any explicit modelling of curvature effects) is found to predict the convex flow more satisfactorily than the flat surface flow in the relaminarizing region. Experimental results and supporting calculations both indicate that the dominant effect of streamwise convex curvature on the mean flow is to promote more rapid and complete relaminarization in an accelerated turbulent boundary layer.