
MMAE SEMINAR



WEDNESDAY, NOVEMBER 17, 2004
E-1 BUILDING – CRAWFORD AUDITORIUM
3:30 – 4:30 PM

Professor Ivan Marusic
University of Minnesota

"Investigation of Large-Scale Structures in Wall Turbulence Using Multi-Plane PIV"

In this seminar results will be reported from an experimental study of zero-pressure-gradient turbulent boundary layers using single-plane and simultaneous dual-plane stereoscopic PIV (Particle Image Velocimetry). Measurements were made on multiple planes in the boundary layer, including cross-stream planes inclined at 45 and 135 degrees to the streamwise direction, together with streamwise-wall-normal and streamwise-spanwise planes. The results show clear evidence of large-scale organization with long streamwise low-momentum zones consistent with the scenario of spatially coherent packets of hairpin vortices in the logarithmic region of the flow. Statistical correlation analysis across the boundary layer indicates the occurrence of a distinct two-regime behavior, in which streamwise-velocity-fluctuation correlation contours either appear to be coupled to the buffer region, or decoupled from it. The demarcation between these two regimes is found to scale well with outer variables. The results are consistent with a coherent structure that becomes increasingly decoupled (or decorrelated) from the wall as it grows beyond the logarithmic region, providing additional support for a wall-wake description of turbulent boundary layers.

Results will also be presented from complementary experiments using a spanwise rake of sensors in both wind tunnel facilities, and in the atmospheric surface layer that develops over the flat terrain of the western desert salt-flats of Utah.