Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Hairpin packet structure of a turbulent boundary layer in inclined wall-normal/spanwise planes[1] JAE HWA LEE, HYUNG JIN SUNG, KAIST — Turbulent coherent structures associated with hairpin packet motions have been scrutinized using the instantaneous flow fields obtained from the direct numerical simulation (DNS) of a turbulent boundary layer (TBL). The Reynolds number based on the momentum thickness was varied in the range Re_θ=890$\sim$2560. This study focused on the hairpin packet motions in inclined wall-normal/spanwise planes. The hairpin vortex signature associated with the hairpin leg components in the vertical inclined plane consists of a counter-rotating vortex pair, upward and downward motions and a stagnation point induced by the Q2 and Q4 events. These hairpin signatures were observed in the instantaneous flow field, in the two-point correlations and in the conditionally averaged flow fields, respectively. We considered three inclined planes (45°, 90°, and 135°) to investigate the spatial characteristics of the hairpin packet motions in the log and wake regions. The statistical flow fields showed that significantly different flow patterns are induced by the intersections of the three inclined planes with the hairpin packet motions.

[1]This work was supported by KISTI under the Strategic Supercomputing Support Program.

Jae Hwa Lee
KAIST

Date submitted: 05 Aug 2009 Electronic form version 1.4