Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Formation mechanisms of rapid pressure recovery around a laminar separation bubble[1] DONGHWI LEE, University of Tokyo, TAKU NONOMURA, AKIRA OYAMA, KOZO FUJII, Institute of Space and Astronautical Science, JAXA — Large-eddy simulations around 5% thickness flat plate are conducted at $Re_c = 5,000, 8,000$ and $20,000$ and formation mechanisms of rapid pressure recovery in the surface pressure distribution around laminar separation bubbles are analyzed. Three analyses are applied to investigate the mechanisms of rapid pressure recovery. First, by using the Reynolds averaged streamwise pressure gradient equation, it is confirmed that the "overall Reynolds stress diffusion (ORSD)" is an important factor for inducing rapid pressure recovery. Second, we decompose the ORSD into the "normal Reynolds stress diffusion in the streamwise direction" and the "tangential Reynolds stress diffusion (TRSD) in the wall-normal direction". We show that the TRSD in the wall-normal direction, which corresponds to the momentum transfer in the same direction, is the main contributor to the ORSD. Third, the TRSD in the wall-normal direction is decomposed into two- and three-dimensional components. The results indicate that the rapid pressure recovery is strongly affected by the presence of Reynolds stress rather than by the type of physical phenomena that creates the Reynolds stress. In other words, the three-dimensional turbulent structures are not a necessary condition for the rapid pressure recovery.

[1]Grain-in-Aid for JSPS Fellows

DongHwi Lee
Univ of Tokyo

Date submitted: 27 Jul 2016 Electronic form version 1.4