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LES study of vortical structures and suction peaks on a 3D square cylinder in turbulent boundary layer TETSURO TAMURA, Tokyo Institute of Technology, YOSHIYUKI ONO, Obayashi Corporation — Sophisticated LES technique has made it possible to reproduce unsteady flows around a three-dimensional square cylinder in turbulent boundary layer. Various flow patterns such as the separation bubble or vortices in the cylinder wake are sensitively changed depending on the angle of attack. It is well-known that local severe suctions occur in the flow separation regions of the cylinder. The experimental study showed that the local severe suctions on the side of the square cylinder were caused by two types of conical vortices. One was a standing conical vortex at the upper edge of windward corner at glancing angle, which leads to large level of negative pressure. The other was an inversion conical vortex on the lower side of the cylinder when the flow normally attacks. This inversion conical vortex was periodically formed and causes the fluctuation of the pressure near the bottom of windward corner. Here, LES is applied to the flow around a square cylinder in boundary-layer turbulence. Instantaneous large negative pressure peaks are randomly recognized in the present computational results. At the same time, inversion conical vortex and conical vortices are intermittently formed in boundary-layer turbulence. Physical mechanism for occurrence of peak pressures has been elucidated.

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