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Vortex dynamics and surface pressure fluctuations on a normal flat plate[1] ARMAN HEMMATI[2], DAVID H. WOOD, ROBERT J. MARTINUZZI, SIMON W. FERRARI, YAOPING HU, University of Calgary — The effect of vortex formation and interactions on surface pressure fluctuations is examined in the wake of a normal flat plate by analyzing Direct Numerical Simulations at Re=1200. A novel local maximum score-based 3D method is used to track vortex development in the region close to the plate where the major contributions to the surface pressure are generated. Three distinct vortex shedding regimes are identified by changes in the lift and drag fluctuations. The instances of maximum drag coincide with impingement of newly formed vortices on the plate. This results in large and concentrated areas of rotational and strain contributions to generation of pressure fluctuations. Streamwise vortex straining and chordwise stretching are correlated with the large ratios of streamwise to chordwise normal stresses and regions of significant rotational contribution to the pressure. In contrast at the minimum drag, the vorticity field close to the plate is disorganized, and vortex roll-up occurs farther downstream. This leads to a uniform distribution of pressure.

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