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Markovian properties of velocity increments in a high Reynolds number turbulent boundary layer[1] MAREN FREDBO, Norwegian University of Science and Technology (NTNU), MURAT TUTKUN, Norwegian Defence Research Establihsment (FFI), Kjeller, Norway — Statistics of velocity increments in a flat plate turbulent boundary layer are investigated using the theory of Markov processes (J. Fluid Mech., Vol. 433, pp. 383-409, 2001). The database analyzed here is a subset of data taken in the 20 m long wind tunnel of Laboratoire de Mécanique de Lille (LML) using a hot-wire rake of 143 single wire probes. The Reynolds number based on momentum thickness, Re_θ, tested in this study was 19 100. The freestream velocity of the tunnel and the boundary layer thickness at the measurement location were 10 m s^{-1} and 30 cm respectively. Our analysis on the increments of longitudinal velocities at different wall-normal positions show that the flow exhibits Markovian properties when the separation (Δr) between different scales is on the order of the Taylor microscale, λ. Initial results indicate that smallest $\Delta r/\lambda$, where the process can be defined as Markovian, decreases from wall to the inertial layer. As the probe moves inside the inertial layer, however, a constant $\Delta r/\lambda$ is observed. The ratio starts growing in the outer layer once the probe leaves the inertial layer.

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