Unsteady Pressure Measurements in a Pickup Truck Model

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SUMMARY

The results of an experimental investigation to determine the mean and unsteady pressure field on a pickup truck are reported. These measurements were conducted as a preliminary step to more detailed measurements of the pickup truck flow field using Particle Image Velocimetry (PIV). Mean pressure on the pickup truck cabin, bed and tailgate was measured at Reynolds number ~2×10^5 with a manometer rake. Unsteady pressure in the pick up truck bed and internal surface of the tailgate was measure at the same flow conditions using a pressure transducer. It was found that very long time averages of the order of several minutes were needed to obtain statistically stable results. The mean pressure fields show the expected behavior of the flow around the pickup truck. The mean pressure field in the bed was found to depend on Reynolds number, with pressure coefficient values slightly lower (ΔC_p~0.05) at the lowest Reynolds number tested. In the bed and at high Reynolds number the mean pressure coefficient near the base of the cab is ~-0.3, increasing to ~-0.2 close to the tailgate. On the inside surface of the tailgate there is a stagnation region in the middle and rapid acceleration towards the edge. Unsteady pressure measurements in the bed show two distinct regions. In the forward section behind the cab the amplitude of the pressure fluctuations is very small <0.6 % of the free stream total pressure. Towards the back of the bed and the inside surface of the tailgate much larger pressure fluctuations are measured ~1.9% of the free stream total pressure. Spectra of the pressure fluctuation revealed an unexpected sensitivity of the pickup truck flow to small amplitude low frequency disturbances in the free stream. Also a spectral peak at Strouhal number of 0.07 associated with flow separation at the edge of the tailgate has been documented. Several other spectral peaks at other frequencies associated with the pickup truck bed flow are discussed, which document the complexity of flow. Recommendations for the on-going PIV tests are listed.