Effect of free stream pulsation on a turbulent boundary layer

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This research investigates the effect of free stream pulsation on a turbulent boundary layer (TBL) in a wind tunnel. The pulsation is created by diverting part of the flow from the blower into a bypass duct with the use of a hinged flap operated by a linear actuator. Velocity measurements are conducted with hot wire anemometers. The time-averaged streamwise velocity is 2.9 m/s, and the pulsation has a nearly sinusoidal waveform with a 20% amplitude and a frequency of 0.33 Hz. The same facility and methodology were recently used to examine the effect of flow pulsation on grid-generated turbulence. This study also provided some cursory results on the effect of pulsation on the TBL under grid turbulence. It was observed that flow pulsation had no significant impact on the time-averaged TBL thickness, but enhanced the turbulent activity in the outer TBL and impeded the spreading of a passive scalar plume from the free stream into the TBL. Experiments in progress focus on the TBL growing along the wind tunnel bottom wall in the absence of a grid, but initially tripped by a rough surface.

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