

Abstract

The Effect of Oscillating Wall on Turbulent Boundary Layer

There are possible physical mechanisms responsible for turbulent production suppression that leads to a drag reduction and near-wall flow modification in zero pressure gradient turbulent boundary layer (ZPG TBL). Transverse motion is one of these mechanisms which can be imposed by either passive means, e.g., riblets or by external forcing, such as travelling-wave excitation or wall oscillation.

The objective of the experiment is to study the effect of oscillation wall at different wall motions, waveforms, and frequencies of oscillation on turbulent production suppression in ZPG TBL.

Hot-wire Anemometer is used to measure TBL on a smooth flat plat in a wind tunnel. A small plate is used to impact the flow. Pitot tube is used to calibrate the Hot-wire Anemometer.

Experiments for sawtooth and sine waveforms at different frequencies show modification in ZPG TBL for some of the motion cases comparing to the non-motion case. For sawtooth waveform at 20m/s speed tunnel case shows a drag reduction in the TBL.

Our future plan is to improve our analysis approach or experiment to reduce uncertainty. Furthermore, using other ways, such as composite profile, Clauster plot, and/or fit DNS data from previous studies to estimate wall shear stress is to improve our analysis. The next phase of this experiment is to increase impacting the flow by actuating in other ways, and/or adding feature to the small plate.