Abstract Submitted
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Turbulent Boundary Layer Response to Sinusoidal Spanwise Perturbation[1] YUAN WANG, Department of Mechanical Engineering, University of Melbourne, RIO BAIDYA, Institute of Fluid Mechanics and Aerodynamics, Bundeswehr University, CHARITHA M. DE SILVA, School of Mechanical and Manufacturing Engineering, University of New South Wales, MATTHEW FU, IVAN MARUSIC, NICHOLAS HUTCHINS, Department of Mechanical Engineering, University of Melbourne — In this study, a developing turbulent boundary layer is perturbed with a sinusoidal spanwise mode. The downstream persistence of these modes, and response of the underlying turbulent structure, is measured using hotwire anemometry. The modes are introduced using spanwise fences with a sinusoidally varying height h of a given spanwise wavelength Λ. The motivation here is to test Townsends analysis which suggests that the turbulent boundary layer is receptive to spanwise periodic modes of certain wavelengths Λ. Hot-wire measurements are performed at different downstream locations and across the span of the introduced perturbation. Preliminary results indicate that high/low momentum pathways will appear behind the peaks/troughs of the perturbations. The persistence of these spanwise heterogeneous patterns are correlated with the ratio Λ/δ, where δ is the boundary layer thickness at the perturbation station. Particularly, the perturbed flow with $\Lambda/\delta \sim 2$, exhibits persistent spanwise periodicity up to 70δ downstream from the perturbation location, whereas the cases with smaller $\Lambda/\delta \sim 1$ seem to recover to canonical spanwise homogeneous conditions over shorter downstream distances.

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