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Reorganisation of the large-scale structures in turbulent boundary layers using highly ordered and directional surface roughness - KEVIN, BAGUS NUGROHO, University of Melbourne, GOKUL PATHIKONDA, JULIO BARROS, University of Illinois, KENNETH CHRISTENSEN, University of Notre Dame, JASON MONTY, NICHOLAS HUTCHINS, University of Melbourne, UOM - UIUC RIBLETS STUDY COLLABORATION[1] — The potential of riblet-type surface roughness with converging-diverging (herring-bone type) arrangements to reorganise the large-scale coherent structures that populate the logarithmic region of turbulent boundary layers is investigated at moderate Reynolds number. The ability of this transitionally rough surface to generate large-scale counter rotating roll-modes suggests that a preferential arrangement of the naturally occurring large-scale structures may have been introduced. Prior analysis of the pre-multiplied energy spectra of streamwise velocity fluctuation indicates an increase (or decrease) in the large-scale streamwise turbulence energy over the converging region (or diverging) of the riblets. In this study we examine this possible spanwise redistribution of the coherent structures using instantaneous planar Particle Image Velocimetry (PIV) in the wall-parallel plane (within the logarithmic region) as well as cross-plane Stereoscopic PIV. The characteristics of the large-scale structure over the converging-diverging surface are compared with those of the corresponding smooth-wall case, revealing pronounced modification of the size, strength and alignment of these features over the directional surface.

[1]Collaboration between University of Melbourne and University of Illinois on converging-diverging riblets study

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