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**Perturbation of roughness-induced secondary flow in a turbulent boundary layer overlying complex roughness** G. PATHIKONDA, Univ. of Illinois, K.T. CHRISTENSEN, Univ. of Notre Dame — Recent experiments investigating flow over more heterogeneous and organized roughness have revealed spanwise inhomogeneity in turbulence statistics interpreted as roughness-induced secondary flow induced by streamwise elongation and spanwise heterogeneity of the topography itself. In particular, spanwise alternating regions of low- and high-momentum pathways in mean streamwise velocity have been observed, each flanked by streamwise oriented counter-rotating roll cells, for flow over both the complex roughness investigated herein and organized roughness reported in the literature. We explore perturbation of this roughness-induced secondary flow as a means of studying its origin and persistence. Spanwise-wall-normal stereo PIV measurements of flow over complex roughness are made, first with an incident smooth-wall turbulent boundary layer upstream of the roughness followed by perturbation of this incident smooth-wall turbulent boundary layer with organized hemispherical roughness elements prior to transition to the complex roughness (with the hemisphere scale being distinct from that of the complex roughness). Hot-wire measurements are also made to capture the energy distribution/re-distribution at various flow scales in both flow conditions.

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