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Experimental investigation of the boundary layer behavior on rectangular cylinders with surface topology[1] KIAN KALAN, MARK FEERO, AHMED NAGUIB, MANOOCHEHR KOOCHESFAHANI, Michigan State University — This work is motivated by possible galloping instability of suspension lines of precision airdrop systems. This aero-elastic instability may lead to self-sustained oscillation due to the unsteadiness in the aerodynamic forces, induced by variation in the instantaneous angle of attack as the cable oscillates normal to the mean flow direction. In order to have better insight into the underlying flow physics, one-component molecular tagging velocimetry has been employed in this study to measure the boundary layer development on cylinders with canonical geometry representing the suspension line cross-section. Specifically, those cylinders have rectangular cross-section with thickness d, side ratio and corner radius of c/d = 2.5 and r/d = 0.5, respectively, and surface topology. Results will be presented for Reynolds numbers of Re_d = 1100 and 2500, with focus on cross-stream profiles of the mean and the fluctuating streamwise velocity component for a range of angles-of-attack. Data will also be presented for baseline smooth-surface cylinders in order to investigate the effect of surface topology.

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Kian Kalan
Michigan State University

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