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An Experimental Study of Surface Topology Effect on the Aerodynamics of Rectangular Cylinders[1] KIAN KALAN, ALIREZA SAFARIPOUR, AHMED NAGUIB, MANOOCHEHR KOOCHESFAHANI, Michigan State University — The motivation behind this study is to provide a fundamental understanding of the effects of surface topology on the instability of rectangular cylinders to galloping. Galloping is a form of aeroelastic instability that elastically-mounted non-circular cylinders may experience and it can lead to large-amplitude self-sustained transverse oscillations of the cylinders (usually normal to the flow direction). Here, the motivating application is the possible galloping of suspension cables of Precision Airdrop Systems, which could potentially impair their ability to land their cargo on target. The cross-section of these cables is nominally rectangular with fully rounded corners and a braided surface topology, which we represent by a two-dimensional Fourier expression. The effects of surface topology and Reynolds number on the aerodynamics of these cylinders are investigated through complementary single-component molecular tagging velocimetry and direct force measurements performed in a closed-loop water tunnel facility. These results are compared to those of a baseline smooth-surface cylinder to provide insight into the links between the flow behavior around the cylinders and their aerodynamic load characteristics.

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