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Interactions of a Cross-flow with Dynamic Discrete Roughness Elements SAMANTHA GILDERSLEEVE, DANIEL SPATCHER, CHIA MIN LEONG, RPI, DAN CLINGMAN, The Boeing Company, MICHAEL AMITAY, RPI, RPI COLLABORATION, THE BOEING COMPANY COLLABORATION
— Flow over passive discrete roughness elements was studied in the past to understand their role in controlling transition from laminar to turbulent boundary layers. In the present study, the use of dynamic roughness elements (i.e., low aspect ratio circular cylinders) was explored. These roughness elements were actuated using piezoelectric strips and were designed to have a frequency range of up to 300 Hz. The interaction of a laminar boundary layer over a flat plate with the dynamic roughness elements was studied with both a single and a spanwise array of roughness elements. The discrete elements were 4 mm in diameter, and with a free-stream velocity of 10 m/s, the Reynolds number based on diameter was about 2500. Simultaneous measurements of the performance of the surface roughness elements and the flow field around them were accomplished using a laser displacement sensor and Stereoscopic Particle Image Velocimetry, respectively. Data were collected along spanwise planes at multiple streamwise locations downstream of the roughness elements for the static and dynamic cases at different protrusions into the boundary layer. For the dynamic cases, the effects of amplitude and frequencies were also explored. Flow structures in the wake of these roughness elements will be discussed.

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