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Interactions of a finite span synthetic jet with a cross flow CHIA MIN LEONG, TYLER VAN BUREN, Rensselaer Polytechnic Institute, EDWARD WHALEN, Boeing, MICHAEL AMITAY, Rensselaer Polytechnic Institute, RENSSELAER POLYTECHNIC INSTITUTE TEAM, BOEING COLLABORATION —
A synthetic jet is a zero-net-mass-flux flow control actuator that produces alternating ejection and suction of fluid momentum across an orifice. It has been used in numerous applications as an active flow control device to improve aerodynamic performance. Though their aerodynamic performance effects are well known, this present study seeks to understand the fluid dynamic effects of synthetic jets. Specifically, the work investigates the interactions of a finite span synthetic jet with a zero-pressure-gradient laminar boundary layer. This study was performed in a small-scale subsonic wind tunnel with an adjustable test section upper wall that was used to generate a zero-pressure-gradient boundary layer. Several finite span rectangular orifices were chosen for this study. Time and phase-averaged Stereoscopic Particle Image Velocimetry (SPIV) measurements were acquired at multiple planes upstream and downstream of the synthetic jet orifice to explore the interaction of the synthetic jet with the cross flow. The effects of the orifice aspect ratio (12, 18, and 24) and blowing ratio (0.5, 1, and 1.5) were investigated. The unsteady vortical structures observed in the near field and the steady structures in the far field are discussed.

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