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Toward Understanding Sparse Sweeping Jet Configurations on Aircraft Control Surfaces[1] EMILE OSHIMA, OLIVER WILD, STEPHANIE RIDER, DAVID JEON, Caltech, ISRAEL WYGNANSKI, University of Arizona, MORTEZA GHARIB, Caltech — Many aerospace research institutions are looking to integrate active flow control (AFC) devices into the design process of next-generation commercial and military aircraft. Sweeping jet actuator (SWJ) arrays are attractive for their reliable design and demonstrated flow control efficacy. Many previous efforts have focused on uniform array designs that cover the entire wingspan. Still, we expect the interaction between the jets and the complex 3D flow over a wing to vary significantly with spanwise location. Experiments are conducted on a short aspect-ratio swept-back wing model in the Lucas Wind Tunnel at Caltech. A spanwise array of twelve SWJ is installed at 80% chord, and each jet is equipped with an on-off mechanism to enable testing of various sparsity levels and distributions. Force measurements, surface tuft visualization, and particle image velocimetry data are combined to understand the different flow physics involved. We show that jets can be grouped mainly into three categories based on spanwise position, providing useful insight for driving future AFC design and optimization processes.

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