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On the Mechanisms of Shear Layer High-Frequency Control. Part I: Experimental Studies[1] BOJAN VUKASINOVIC, ARI GLEZER, Georgia Institute of Technology — The high-frequency fluidic actuation and the ensuing evolution of small- and large-scale motions in a turbulent shear layer are investigated experimentally. The high-frequency (substantially higher than the natural flow frequencies) actuation is effected through the boundary layer just upstream from the shear layer origin. The ensuing flow is characterized in the spatial and spectral domain by high-resolution diagnostic tools. It is shown that open-loop, high-frequency control modifies the shear layer energy distribution within the finite domain. Immediately downstream from the control origin, a significant increase in both production and dissipation of turbulent kinetic energy is detected, which indicates enhanced energy transfer from the mean flow. This initial domain is spatially followed by a larger domain in which the production of turbulent kinetic energy is suppressed, i.e., the shear layer becomes stabilized with respect to the turbulent kinetic energy. Beyond this spatial range of influence, significant energy content is re-established at frequencies lower that in the uncontrolled flow, as governed by the local shear layer momentum thickness. Therefore, evolution of shear layer dominant scales becomes both spatially delayed and reduced in frequency, as a consequence of the direct high-frequency control.

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