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Separation Dynamics of Controlled Internal Flow in an Adverse Pressure Gradient C. J. PETERSON, B. VUKASINOVIC, A. GLEZER, Georgia Institute of Technology — The effects of fluidic actuation on the dynamic evolution of aggressive internal flow separation is investigated at speeds up to M = 0.4 within a constant-width diffuser branching off of a primary flow duct. It is shown that a spanwise array of fluidic actuators upstream of the separation actively controls the flow constriction (and losses) within the diffuser and consequently the local pressure gradient at its entrance. The effectiveness of the actuation, as may be measured by the increased flow rate that is diverted through the diffuser, scales with its flow rate coefficient. In the presence of actuation (0.7% mass fraction), the mass flow rate in the primary duct increases by 10% while the fraction of the diverted mass flow rate in the diffuser increases by more than 45%. The flow dynamics near separation in the absence and presence of actuation are characterized using high speed particle image velocimetry and analyzed using proper orthogonal and spectral decompositions. In particular, the spectral contents of the incipient boundary layer separation are compared in the absence and presence of actuation with emphasis on the changes in local dynamics near separation as the characteristic cross stream scale of the boundary layer increases with separation delay.

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