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Active Flow Control in an Aggressive Transonic Diffuser[1] RYAN W. SKINNER, KENNETH E. JANSEN, Univ of Colorado - Boulder — A diffuser exchanges upstream kinetic energy for higher downstream static pressure by increasing duct cross-sectional area. The resulting stream-wise and span-wise pressure gradients promote extensive separation in many diffuser configurations. The present computational work evaluates active flow control strategies for separation control in an asymmetric, aggressive diffuser of rectangular cross-section at inlet Mach ~ 0.7 and Re ~ 2.19M. Corner suction is used to suppress secondary flows, and steady/unsteady tangential blowing controls separation on both the single ramped face and the opposite flat face. We explore results from both Spalart-Allmaras RANS and DDES turbulence modeling frameworks; the former is found to miss key physics of the flow control mechanisms. Simulated baseline, steady, and unsteady blowing performance is validated against experimental data.

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