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Active Flow Control of a Transonic Shock over Curved Surfaces
ABRAHAM N. GISSEN, BOJAN VUKASINOVIC, ARI GLEZER, Georgia Institute of Technology, SIVARAM P. GOGINENI, Spectral Energies — The effects of fluidic actuation on the evolution and dynamics of a transonic shock over a two-dimensional convex surface by controlling the ensuing shock-induced separation are investigated in wind tunnel experiments. Actuation is effected by a spanwise array of high-frequency (nominally 10 kHz) fluidic oscillating jets. The flow field upstream and downstream of the shock is investigated using high-speed Schlieren and PIV (3,000fps), and surface pressure measurements. It is shown that control of the shock-induced separating shear layer by exploiting direct control of small-scale motion can alter the degree of flow attachment and have a profound effect on the shock dynamics. The actuation diminishes shock oscillations near the surface, and leads to streamwise shock displacement that is proportional to the actuation strength (as measured, for example, by the mass flow rate coefficient). The strong correlation between the shock displacement and surface pressure are explored for application of closed-loop control.

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