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Modification of shear layer characteristics using local periodic heating[1] CHI-AN YEH, PHILLIP MUNDAY, KUNIHIKO TAIRA, Florida State University — Motivated by the recent development of carbon-based thermophone membranes, we examine their use as a flow control actuator by performing 2D DNS of a compressible subsonic shear layer downstream of a splitter plate for a plate thickness based Reynolds number of 4000. Time varying heat flux boundary condition is utilized as the membrane actuator model on the elliptic nose of the splitter plate. A range of boundary layer thicknesses θ and actuation frequencies are chosen to study the effectiveness of the actuator in modifying the shear layer physics through changing vortex rollup and vortex merging dynamics. For incoming boundary layer with large θ, the heat injection does not shift the rollup frequency when using actuation frequencies between the baseline rollup frequency and its first subharmonic. However, vortex merging is observed to occur earlier downstream. When a positive mean heating is introduced at the same frequency, the early occurrence of the vortex merging is still observed even if the fundamental rollup is delayed due to increased viscosity from the local heating near the nose. For shear layers with small θ, the rollup occurs earlier than the baseline and is locked onto the actuation frequency, but no significant change in the merging is observed.

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