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Kelvin-Helmholtz Instability in Compressible Flows and Mixing Inhibition MONA KARIMI, Department of Mathematics, Texas A&M University, SHARARATH GIRIMAJI, Aerospace Engineering Department, Texas A&M University — It is well-established that the Kelvin-Helmholtz (KH) instability is central to shear flow mixing. Toward understanding the suppression of turbulent mixing under the influence of compressibility, we first examine the modification to KH instability in a planar mixing layer at high speeds. In this presentation, combining the outcomes of the linear stability analysis with the results of the numerical simulation, we establish that the flow domain can be classified into two main regions: the outer regions on the fast and slow sides and dilatational interface layer (DIL) in the middle. Compressibility engenders the formation of a dilatational or acoustic layer at the high-shear interface between two streams of different speeds. Within the DIL, the velocity perturbations become oscillatory. In the incompressible shear layers, the interface experiences steady vortical motion that entrains fluid from both streams leading to familiar KH behavior. In contrast, in the compressible case, the interface motion is oscillatory inhibiting vortex-merging and roll-up, thereby suppressing entrainment that leads to inhibition of the KH instability. Analysis and illustrations of the constituent mechanisms are presented.

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