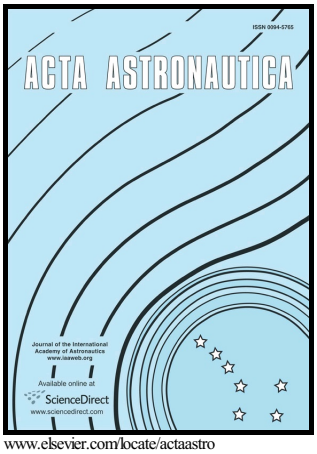

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Entrainment characteristics of cavity shear layers in supersonic flows

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Abstract: Two-dimensional large eddy simulations have been carried out to investigate entrainment characteristics of cavity shear layers in supersonic flows, which is crucial to the understanding and modeling of cavity-stabilized combustion for scramjet applications. Effects of free-stream Mach number and cavity configuration are investigated. The stability and growth rate of the cavity shear layers are found to strongly depend on the compressibility effects, similar to those observed in the free shear layers. However, the growth rate of the cavity shear layers is much higher under low supersonic conditions and decreases more rapidly with increasing Mach number when compared to that of free shear layers. Cavities with larger length-to-depth ratio or larger aft angle appear to have greater shear-layer growth rate. Entrainment of the free-stream fluids into the cavity recirculation zone is to a large extent determined by the interactions between the shear layer and the cavity aft wall. The mass flux entrainment ratio of the cavity shear layers appears lower than that of free shear layers and basically ranges from 0.6 to 1.7 under the present conditions.

Keywords: scramjet; large eddy simulation; shear layer; growth rate.