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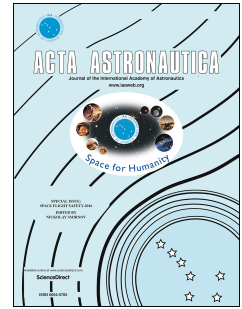
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Structures of near-wall wakes subjected to a sonic jet in a supersonic crossflow

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Abstract

Nanoparticle-based Planar Laser Scattering (NPLS) technology and Oil flow visualization are employed to investigate the wake flow of a sonic jet injected into a supersonic crossflow at $Ma=2.95$. Experiments are run for seven jet-to-crossflow momentum flux ratios (J) of 2.3, 5.5, 7.7, 11.2, 16.0, 20.6, and 28.9 of a sonic jet injected into a supersonic crossflow at $Ma=2.95$. Experimental results suggest that the near-wall wake zone could be divided into three regions: the V-shape separation region behind the jet, followed by the reattachment region and the mixing and recovery zone further downstream. Lower jet-to-crossflow momentum flux ratio cases always have shorter distance from the orifice to the interaction position of the V-shape collision shock and the reflected shock. The angle between the main separation lines is found to be independent of J . Correlations for predicting the separation length and width are proposed based on the experiments of different momentum flux ratios.

Keywords: Jet wake, Supersonic flow, V-shape separation region, NPLS, Oil-flow

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