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Experimental investigation on the effectiveness of active control mechanism on base pressure at low supersonic mach numbers (Article)

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Abstract

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In the current investigation, the experiments were carried out to evaluate the effectiveness of microjets in controlling the base pressure from a convergentdivergent nozzle at low supersonic Mach at different expansion level. Tests were carried out for low supersonic Mach numbers 1.25, 1.3, 1.48, and 1.6 while nozzle pressure ratio ranges from 3 to 11. The jets are augmented abruptly into an axisymmetric circular channel with different cross-sectional areas as that of nozzle exit area. The results show that the proficiency of the microjets is only marginal in controlling the base pressure even under the influence of favorable pressure gradient at lower NPRs namely 3 and 5. It was also observed that for higher values of the NPRs such as 7, 9, and 11, the dynamic control by very small jets results in rise of base pressure for the different values of the L/D ratios of these investigations. For NPRs 5 and 7, the trend differs due to the level of expansion, nature of waves present in the base region, relief available to the flow, length to diameter ratio of the enlarged duct, and the Mach numbers. It is seen that most of the cases exhibit similar behavior for higher as well as the lower length to diameter ratios, which means; that the back pressure has not adversely influenced the flow field in the base region as well as in the duct. With this it can be stated that the microjets can be an alternative for the experimentalist for base pressure control in the form of microjets.

Author keywords

Abrupt expansion Active control Base pressure Nozzle pressure ratio

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