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INVESTIGATION ON THE CONSEQUENCES OF EMPLOYING DUAL THROAT MICRONOZZLE IN MICROSATELLITE PROPULSION

Abstract

Micro cold gas thrusters are used in microsatellite for maneuvering and to control attitude. Micro thrusters should produce low level thrust and impulse for precise maneuvering of microsatellites. This requirement of thrust can be met by employing dual throat nozzle (DTN) in micro thrusters. Use of DTN eliminates moving parts and avoids mass addition. In this paper, the research has been made on the effects of dual throat in 2D supersonic micronozzle. Design of DTN consists of a cavity between upstream throat and exit of micronozzle. Fluidic blowing is injected at the upstream minimum area which maximizes the pressure differences in the cavity. The nozzle has been designed addressing constraints such as viscous effects, heat transfer effects and flow rarefaction effects. Computational analysis is made on nozzle using high density fluids. Performance characteristics and dimensions of nozzle is evaluated by varying secondary mass flow rate and nozzle pressure ratio. Iterations are performed on different configurations of dual throat micronozzle and thrust vectoring characteristics are calculated for the same.