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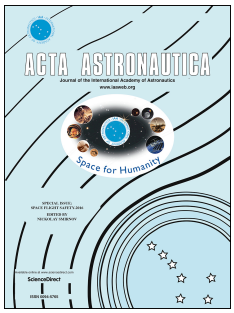

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Design of a Three-dimensional Scramjet Nozzle Considering Lateral Expansion and Geometric Constraints

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Abstract

A new method based on quasi two-dimensional supersonic flow and maximum thrust theory to design a three-dimensional nozzle while considering lateral expansion and geometric constraints is presented in this paper. To generate the configuration of the three-dimensional nozzle, the inviscid flowfield is calculated through the method of characteristics, and the reference temperature method is applied to correct the boundary layer thickness. The computational fluid dynamics approach is used to obtain the aerodynamic performance of the nozzle. Results show that the initial arc radius slightly influences the axial thrust coefficient, whereas the variations in the lateral expansion contour, the length and initial expansion angle of the lower cowl significantly affect the axial thrust coefficient. The three-dimensional nozzle designed by streamline tracing technique is also investigated for comparison to verify the superiority of the new method. The proposed nozzle