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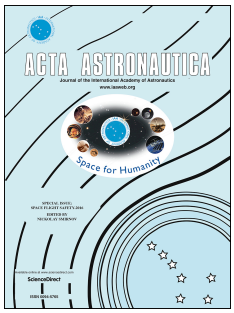

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Numerical Simulation of Divergent Rocket-based-combined-cycle Performances under the Flight Condition of Mach 3

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Abstract

Currently, the upper operating limit of the turbine engine is Mach 2+, and the lower limit of the dual-mode scramjet is Mach 4. Therefore no single power systems can operate within the range between Mach 2+ and Mach 4. By using ejector rockets, Rocket-based-combined-cycle can work well in the above scope. As the key component of Rocket-based-combined-cycle, the ejector rocket has significant influence on Rocket-based-combined-cycle performance. Research on the influence of rocket parameters on Rocket-based-combined-cycle in the speed range of Mach 2+ to Mach 4 is scarce. In the present study, influences of Mach number and total pressure of the ejector rocket on Rocket-based-combined-cycle were analyzed numerically. Due to the significant effects of the flight conditions and the Rocket-based-combined-cycle configuration on Rocket-based-combined-cycle performances, flight altitude, flight Mach number, and divergence ratio were also considered. The simulation results indicate that matching lower altitude with higher flight Mach numbers can increase Rocket-based-combined-cycle thrust. For another thing, with an increase of the divergent ratio, the effect of the divergent configuration will strengthen and there is a limit on the divergent ratio. When the divergent ratio is greater than the limit, the effect of divergent configuration will gradually exceed that of combustion on supersonic flows. Further increases in the divergent ratio will decrease Rocket-based-combined-cycle thrust.

Key Words

Rocket-based-combined-cycle, ejector rocket, divergent configuration, numerical simulation, Mach 3

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