SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic and Combined Cycle Propulsion (9)

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PRELIMINARY DESIGN AND PERFORMANCE STUDIES OF A WIDE RANGE ROCKET-BASED COMBINED CYCLE ENGINE

Abstract

Rocket-Based Combined CycleRBCCengine, which is formed out of rockets and ramjet/scramjet by structurally integration and thermodynamic cycle combination, can be designed into different types and configuration to adapt to different mission requirements. According to both of acceleration and cruise performance requirements, a wide operating range RBCC engine scheme was presented in this paper, based on variable geometry inlet of contraction-ratio adjustment, fixed-geometry combustor of thermal-throat regulation and variable geometry nozzle of expansion-ratio adjustment for adaptation to wide Mach number range operating requirements. Numerical simulations of the full flow-path reactive flow-field at typical flight conditions were carried out for basic engine performance studies. Furthermore, the influences of rocket-jet condition on engine performance and thrust regulating characteristics during wide Mach Number range were analyzed. The results show that: 1superior specific impulse for high Mach number cruise were achieved while quite large thrust generated for low Mach number acceleration2a large thrust regulating range and agile,convenient thrust regulating ability were realized during during the wide Mach Number operating envelope, thrust regulating ratiothe maximum/the minimumis obviously increased with flight Mach number rising; 3the basic performance and characteristics obtained from the present efforts have preliminarily validated the great advantages of acceleration ability and maneuverability of RBCC engine, the flow-path design optimization and combined cycle performance optimum control are needed according to the specific mission requirements.