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

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# NUMERICAL INVESTIGATION ON THE FULL FLOWPATH PERFORMANCE OF RBCC ENGINE

**Abstract**

Rocket based combined cycle (RBCC), as one of the most important direction for future space propulsion, has many technical characteristics such as wide operating range, high specific impulse, large thrust and reusability, which is suitable for space transportation, missile weapon, hypersonic flight vehicle and other application fields. The design of RBCC full flowpath was carried out, which adopting a mixed compression 2-D inlet with the variable geometry of rotating throat and scalable lip, two stage combustor with different expansion ratio and the nozzle with fixed expansion ratio. The numerical calculation results of full flowpath showed that at the operating condition of Ma3, the combustion organization should be performed in the flowpath with large expansion ratio, with pylon for fuel injection and the flame stability of rocket jet and cavity. For the condition of Ma4-6, the combustion organization should be performed in the flowpath with small expansion ratio. Ma4 condition adopted multistage fuel injection and the flame stability of cavity. For Ma5 and Ma6 condition, adopted fuel injection at the rear-faced step and the flame stability of rear-faced step and cavity. The matching work and performance of full flowpath were achieved. Combination the calculation results of Ma2 and Ma7 conditions, showed that the full flowpath of RBCC engine designed in this dissertation could obtained better performance in the range of Ma2-7, which verified the wide adaptability of engine.