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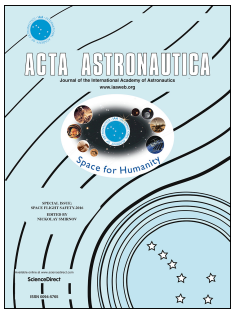

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Mixing and Combustion Enhancement of Turbocharged Solid Propellant Ramjet

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Abstract: Turbocharged Solid Propellant Ramjet is a new concept engine that combines the advantages of both solid rocket ramjet and Air Turbo Rocket, with a wide operation envelope and high performance. There are three streams of the air, turbine-driving gas and augment gas to mix and combust in the afterburner, and the coaxial intake mode of the afterburner is disadvantageous to the mixing and combustion. Therefore, it is necessary to carry out mixing and combustion enhancement research. In this study, the numerical model of Turbocharged Solid Propellant Ramjet three-dimensional combustion flow field is established, and the numerical simulation of the mixing and combustion enhancement scheme is conducted from the aspects of head region intake mode to injection method in afterburner. The results show that by driving the compressed air to deflect inward and the turbine-driving gas to maintain strong rotation, radial and tangential momentum exchange of the two streams can be enhanced, thereby improving the efficiency of mixing and combustion in the afterburner. The method of injecting augment gas in the horizontal direction and making sure the injection location is as close as possible to the head region is beneficial to improve the combustion efficiency. The outer combustion flow field of the afterburner is an oxidizer-rich environment, while the inner is a fuel-rich environment. To improve the efficiency of mixing and combustion, it is necessary to control the injection velocity of the augment gas to keep it in the oxygen-rich zone of the outer region. The numerical simulation for different flight conditions shows that the optical mixing and combustion enhancement scheme can obtain high combustion efficiency and have excellent applicability in a wide working range.

Key words: Turbocharged Solid Propellant Ramjet; Numerical Simulation; Mixing and Combustion; Combustion Efficiency; Specific Impulse

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