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INFLUENCE OF INLET AIR TEMPERATURE FOR DILUTION MIXING IN TURBINE-BASED AIR-BREATHING PROPULSION SYSTEM

Abstract

The performance of propulsion system directly affects the success of the design of entire aircraft. An air-breathing propulsion system with the turbine-based engine can achieve the high-speed flight of the aircraft from zero initial speed. The temperature regulation in different engines in the propulsion system is essential for the stable and reliable operation of the propulsion system. The temperature distribution has a great effect on the reliability and security in different engines. In this paper, the exit temperature distribution of a small engine combustor with three injectors test module was experimentally obtained to qualitatively analyze the influence of the inlet air temperature. It can be concluded that the influence of inlet air temperature will make a different dilution mixing performance at the inner and outer liner. The inlet air temperature can affect the dilution jet penetration. High T3 produces a large penetration depth which has an effective impact for temperature mixing. Due to the effects of the curved channel, the dilution jets of inner and outer liner may accelerate and make a difference on the jet path. With the increase of T3, the inner and outer dilution jets get close to the outer liner. As a result, the gas at outer liner is mixed effectively with a stream of low temperature value at the exit plane and a high temperature value at the inner. The increase of inlet air temperature will result in a bad mixing with high pattern factor. However, it may adjust the temperature distribution at different radial position with a more effective mixing at the outer liner of the combustor and an invalid one at the inner. The experimental results and simulation analysis of this paper show the variation of temperature field under different intake conditions, which will guide the independent and coupled control of heat and temperature in the propulsion system with turbine-based engine.