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MIXING AND COMBUSTION CHARACTERISTICS WITH LOBE NOZZEL UPSTREAM OF A V-GUTTER IN A SUBSONIC FLOW

Abstract

Numerical simulations have been performed to investigate the mixing and combustion characteristics in a subsonic combustor worked in Air Turbo Rocket/Ramjet(ATR) engine with lobe nozzle upstream of a V-gutter as flameholder in a subsonic air flow with stream Mach number 0.4. Using methane as fuel,the flowfield is calculated by Large Eddy Simulation with the reactions provided as 10 steps. Non-reacting experiments have also been presented. The combustor has a long duct shape with a cross section area 40*50 mm. The fuel distribution and mixing process in streamwise direction is revealed clearly by a partical image velocimetry(PIV)system. As in subsonic flow, mixing is due to the conbined effect of lobe nozzle and V-gutter. Compared with mixing caused by V-gutter only, experimental and numerical results have shown that the shear layer behind the V-gutter is asymmetric influenced by the streamwise vortices led by lobe nozzle, mixing intensified in the back of V-gutter, and that the strength and scale of vortex downstream of the V-gutter has been changed due to streamwise vortices. Considered reactions, numerical results have shown more complex weak structure, more effective combustion, with less total pressure loss.