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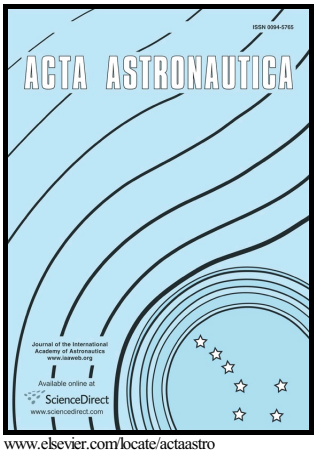

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Abstract

This study reports combustion characteristics of a rocket-based combined-cycle engine combustor operating at ramjet mode numerically. Compressible large eddy simulation with liquid kerosene sprayed and vaporized is used to study the intrinsic unsteadiness of combustion in such a propulsion system. Results for the pressure oscillation amplitude and frequency in the combustor as well as the wall pressure distribution along the flow-path, are validated using experimental data, and they show acceptable agreement. Coupled with reduced chemical kinetics of kerosene, results are compared with the simultaneously obtained Reynolds–Averaged Navier–Stokes results, and show significant differences. A flow field analysis is also carried out for further study of the turbulent flame structures. Mixture fraction is used to determine the most probable flame location in the combustor at stoichiometric condition. Spatial distributions of the Takeno flame index, scalar dissipation rate, and heat release rate reveal that different combustion modes, such as premixed and non-premixed modes,