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ENHANCING THE PERFORMANCE OF SOLID-FUEL DUAL SCRAMJET THROUGH INNOVATIVE DESIGN AND NUMERICAL INVESTIGATION

Abstract

Achieving high-speed performance over a wide range is a critical challenge in various applications. The Solid Fuel Dual Scramjet (SFDSJ) offers a promising solution to enhance vehicles speed and range. In this study, we propose and numerically investigate a novel dual scramjet design using two solid fuels while maintaining simplicity of classical designs. We employ quasi-one-dimensional fluid equations, a solid fuel regression rate model, and finite-rate chemistry for simulation. Factors such as area changes, friction, mass injection, fuel mixing, and heat transfer are considered. Unsteady combustion is approximated as steady, with energy release modeled from a fuel-mixing perspective. Results are validated against experiments, revealing improved regression rates and overall performance for the new design. We also discuss potential applications in rocket-based combined-cycle systems and dual scramjet missile engines, highlighting the versatility of this technology in advancing space and transport applications.