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Hypersonic Air-breathing and Combined Cycle Propulsion, and Hypersonic Vehicle (7)

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DESIGN OPTIMIZATION AND ANALYSIS OF HTHL SUBORBITAL SPACEPLANES PROPELLED
BY HYBRID ROCKET MOTORS

Abstract

In this paper, a design optimization and parameter analysis of a horizontal takeoff horizontal landing (HTHL) suborbital spaceplane propelled by a hybrid rocket motor (HRM) is proposed. Referenced by a prototype, an integrated design model, including the mass and shape estimation, HRM design, aerodynamic calculation and trajectory simulation, is established. A series of long-burning experimental tests in reference article is adopted to modify the influence of nozzle erosion on HRM. After modified, the results of HRM design are well fitted with the test ones, which verified the precision of the modified model and revealed the importance of erosion effect on HRM performance. Then, the integrated design process is built and optimized by the MIGA algorithm. The results are indicated that the designed HRM-propelled suborbital spaceplane could achieve the target flight height under all the constraints. The Parameter analysis (PA) based on optimum result is adopted to analyze the influences of design variables on the performance parameters of the HTHL suborbital spaceplane, and it also gives theoretical reference to the design optimization of the similar aerospace vehicles.