

Entering into Space and New Energy and Propulsion Technology (7)

Entering into Space and New Energy and Propulsion Technology (1)

Author: Mr. Hao Guo

Science and Technology on Space Physics Laboratory, China, guohao_calt@163.com

Mr. Chunling Xu

Science and Technology on Space Physics Laboratory, China, ylfxc@126.com

Mr. Huan Jiang

Science and Technology on Space Physics Laboratory, China, ZYA79@163.com

INTEGRATION OPTIMIZATION OF TRAJECTORY AND RBCC ENGINE SCHEME FOR SUBORBITAL LAUNCH VEHICLE

Abstract

Rocket based combined cycle (RBCC) engine, powered to horizontal takeoff reusable suborbital launch vehicle (SLV), has many advantages of low cost, high reliability, which has raised full attention. In this paper, the issue of integration design and optimization for SLV powered by RBCC engine is discussed. According to the characteristics of the SLV based on RBCC engine, an idea of integrated optimization for trajectory and RBCC engine scheme is proposed. The mathematical model of SLV is established, including the mass model, dynamics model, aerodynamic model, flight procedure controlling model, and engine interior ballistic model. The variables and constraints of the trajectory and RBCC engine scheme integration optimization are determined. The hierarchical optimization strategy, combined with genetic algorithm and pseudo-spectral method, is proposed. The suborbit injection velocity is set as objective function. Genetic algorithm is adopted in external layer to search the optimization solution of system parameters, the propellant fuel and handover Mach number between different modes of RBCC engine under each mode. Pseudo-spectral method is adopted in interior layer for trajectory optimization to ensure each group of system parameters is corresponding to optimal flight procedure. It is estimated that simulation results would illustrate fuel consumption reduce obviously and flight range increased effectively.