

Research on Integrated Design and Optimization for Hypersonic-Glide Vehicle

Jianquan Ge¹, Longyun Chen, Bin Zhang, Lei Wang

¹National University of Defense Technology, Changsha, China, jack_keh@sina.com;

Abstract

The emergence of Hypersonic-Glide Vehicle (HGV) in the hypersonic regime brings a new series of technical challenges, such as strong system integration of parametric model, aerodynamics, thermal, trajectory, and problems about rapidly selecting acceptable conceptual designs. Traditionally, the subsystem of HGV models is designed and optimized separated without considering coupling, leading to losing the globally optimal solution. In this paper, the HGV Integrated Design Environment (HGVIDE) for HGV design and optimization will be presented, to improve the quality and efficiency of the traditional single solution optimization. First of all, a parametric design method based on class function/shape function transformation (CST) and power function was established as the starting step on which the engineering estimation models for aerodynamic force and flux were executed. Secondly, it assesses the effect of vehicle design variables on the maximum lift-drag ratio boost-glide trajectory. Finally, the performance optimization problem is presented, which demonstrate the application of optimization techniques to the multi-disciplinary and multi-objective design of HGV. The investigation shows that the methods feature higher efficient and further complete, thus can give better optimal results for HGV integrated design and optimization problems.

Keywords: hypersonic-glide vehicle; parametric modeling, integrated design; multi-objective optimization.