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AIRFRAME-ENGINE OPTIMIZATION FOR RAMJET/SCRAMJET ALONG FIGHT TRAJECTORY

Abstract

Airframe-engine optimization is important in the design of ramjet/scramjet, because they are strictly coupled with each other, especially for aerospace vehicles. A synchronous optimization of the airframe and engine for ramjet/scramjet is formed and solved in this study. In contrast to conventional research at a single design point, the present optimization is carried out along the entire fight trajectory across a wide range of Mach number, angle of attack, and attitude. A two level optimization is used to improve convergence. The external optimization solves the optimal vehicle geometry configuration and the internal optimization solves the optimal fight trajectory for a given configuration. Specially, the engine geometry adjustment variables, which affect the shapes of the inlet cowl and the nozzle undersurface, are treated as additional control variables and are optimized simultaneously in the trajectory optimization. Research shows that, the performance of ramjet/scramjet is improved obviously after optimization. Furthermore, the optimal inlet and nozzle adjustments along the flight trajectory are obtained and both the aerodynamic and propulsion performances of the airframe-engine integration are improved effectively.