

THERMO-STRUCTURAL DESIGN, ANALYSIS AND TESTING OF A SCRAMJET ENGINE PROPULSION FLOW DUCT

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Abstract

This paper describes the thermo-structural design, analysis and qualification tests carried out for a typical scramjet engine flow duct subjected to transient thermal, aerodynamic pressure and inertial loads. The thermal response of the structure under the aerodynamic heat flux for the ascent trajectory is used as the input for the thermo-structural design and analysis. The deformation and stress induced due to the combined mechanical and thermal loads are estimated through detailed analysis. Based on the results, the configuration is modified and further the thermal loads are re-evaluated. This cycle is repeated till sufficient thermal and structural margins are achieved with least mass. The realised hardware is qualified through structural and thermo-structural tests demonstrating the design adequacy and similar hardware is successfully used in flight.

Keywords: Scramjet Engine, Thermo-structural Design, Finite Element Analysis, Structural Test