Aerospace Engineering Thesis Defense

A "Mission Code" Approach to Conceptual Design of Hypersonic Vehicles

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Abstract

This thesis describes the extension of an aircraft-style time-step integrating mission performance simulation to address aero-spaceplane design challenges. The result is a computationally lean program compatible with current Multi-Disciplinary Optimization schemes to assist in the conceptual design of hypersonic vehicles. To do this the starting aircraft style "Mission Code" required enhancements to the typical point-mass simulation for high altitude and high Mach flight. Stability parameters and the rigid-body modes of Short-Period and Dutch-Roll are tracked to understand time-domain limits to aerodynamic control, along with monitoring the Lateral Control Departure Parameter to ensure that the aircraft is not spin prone. Additionally, experience has shown that for high Mach Number flight designers must consider aerothermodynamic effects early in the vehicle design process. Thus, an engineering level aerothermodynamic model is included. Comparisons to North American X-15 flight test datasets demonstrate the validity of an application of this method and trade studies conducted show the utility of this application.

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