Aerospace Engineering Thesis Defense

Increasing Lateral-Directional Controllability and Investigating Elevator-Body Flap Interaction for Shuttle Orbiter

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Abstract

This thesis investigates the configurations needed to demonstrate positive lateral-directional controllability across the flight envelope of a hypersonic vehicle. We examine the NASA Space Shuttle Orbiter as a baseline reference configuration, as it was a successful hypersonic vehicle. However, the Orbiter had limited high-speed maneuvering capability; it relied on reaction-control jets to augment controllability due to a strong tendency for its aerodynamics to "control couple." We realize that many problems associated with the control of the hypersonic Orbiter are due to its slender configuration. This work relies upon the Evolved-Bihrle-Weissman chart as an accurate indicator of lateral-directional stability and controllability. We will also explore variant configurations of larger wing tip verticals to explore what configuration changes are needed to reduce dependence on reaction controls.

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