Adaptive Guidance Law for Trajectory Control of a Reusable Launch Vehicle during Air-Breathing Ascent Phase

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Abstract

An adaptive guidance scheme is developed for air-breathing ascent phase of a Reusable Launch Vehicle (RLV). The guidance law controls the vehicle lift force using a Proportional Derivative (PD) controller. A gain adaptation algorithm is developed that modifies the feed back controller gains on-line, in response to the changes in vehicle performance and the nature of disturbance. The system dynamics is propagated to the end of atmospheric ascent phase considering angle of attack as the active control variable. The adaptive guidance law is validated through extensive flight simulations for air- breathing engine off nominal performance, aero parameter uncertainties and atmospheric density perturbations. The simulation results establish the robustness of the newly developed algorithm to meet the mission requirements, satisfying the path constraints and terminal constraints.