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APPLICATION OF STRUCTURED SINGULAR VALUE METHOD TO AEROSERVOELASTIC ROBUSTIC STABILITY ANALYSIS FOR REUSABLE LAUNCH VEHICLE

Abstract

Reusable Launch Vehicle (RLV) usually has low overall structure stiffness and high authority flight control system, and must withstand complex flight environment and serve aerodynamic heating during reentry. Factors above may easily induce aeroservoelastic stability problem that involves structure dynamics, unsteady aerodynamics, heat and control. Due to modeling complexity, multiple uncertainties and coupling between control channels, traditional stability analysis methods are inapplicable to RLV. In this paper, based on vehicle aeroservoelastic nominal system modeling, Linear Fractional Transformation is used to establish aeroservoelastic state-space models of subsystems and the whole closed loop system considering multiple uncertainties, and structured singular value μ-method is used to analyze system robustic stability. Modeling scheme and μ-method are proved valid and promising in aeroservoelastic robustic stability analysis for RLV by analytical results.

Key words: μ-Method; Reusable Launch Vehicle; Aeroservoelasticity; Robustic Stability; Structured Singular Value