MATERIALS AND STRUCTURES SYMPOSIUM (C2) Space Structures - Dynamics and Microdynamics (3)

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RESEARCH ON METHODOLOGY OF AEROSERVOELASTIC STABILITY ANALYSIS FOR REUSABLE LAUNCH VEHICLE

Abstract

Using wing-body configuration and big lifting surface and control surface, 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. In this paper, motion equations of flexible flight vehicle are deduced by using Lagrangian method considering coupling between rigid-body modes and elastic vibration modes. State-space model of closed-loop aeroservoelastic system is established based on rational function approximation of unsteady aerodynamics and modeling of servosystem and flight control system. Furthermore, eigenvalue method, Nyquist criteria, the minimal singular value theory and the structured singular value analysis are studied for aeroservoelastic stability analysis, and some conclusions are drawn consequently.

Key words: Reusable Launch Vehicle; Aeroservoelasticity; Stability; Structured Singular Value; $\mu\text{-}$ Method