SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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FLIGHT TRAJECTORY ANALYSIS ON ADVANCED MORPHING SPACE TRANSPORTATION SYSTEM FOR WIDER CROSS RANGE AND DOWN RANGE WITH TRIMMED FLIGHT

Abstract

The flight regimes of RLV must cover from hypersonic regime to subsonic regime. Therefore, conventional space transportation systems, whose geometry is designed mainly for re-entry phase, could not always realize best aerodynamic performance in all flight conditions. In order to overcome those problems, a new concept of space transportation system named Morphing Space Transportation System, whose configuration changes in order to have better aerodynamic characteristics at each flight regime, has been proposed by the present authors. For strategy of development of promising configuration of Morphing Space Transportation high lift to drag ratio (L/D) and high lift coefficient (CL) are selected as estimation parameters for high aerodynamic performance. Also the candidates of morphing configuration should satisfy the proposition that all candidate configurations should be realized by deforming baseline configuration. Higher L/D results in wide cross range and long downrange as well as higher levels of maneuverability. On the other hand, higher CL enables the vehicle to land at lower landing speed, and thus led to increase in safety and choices of runway. Those configurations of morphing RLV have been investigated from in hypersonic flight regime to in subsonic flight regime. Finally the recommended series of morphing configuration of RLV have been proposed. In order to investigate the capability of our idea of Morphing Space Transportation experimental study has been conducted from Mach number of 0.3 through 4.0. The various configuration of Morphing Space Transportation have been tested and optimum configurations with higher L/D (lift to drag ratio) has been discovered for every flight regime. Also Flight Trajectory Analysis has been conducted by simulating flight trajectory from reentry to landing starting from an altitude of 100km. In the present analysis L/D of each morphing configuration with trimmed flight is selected. The results suggest that morphing space transportation system can extend its down range more than 2400 km and cross range more than 2000 km. The results means that proposed morphing space transportation system has excellent access capability to many airports for re-entry. Also proposed morphing space transportation system could select one of possible paths during re-entry because the distance between neighboring paths is limited from about 2000 km to 3000 km for low earth orbit with low inclination angle.