Paper ID: 77526
oral
student

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry & Landing Systems (3)

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A STUDY OF THE REEFING SYSTEM OF A SUPERSONIC PARACHUTE FOR MARS EXPLORATION

Abstract

As a deceleration device, parachute plays an important role in vehicle recovery and deep space exploration. The current parachute used for Mars exploration has reached the performance limit. Due to system weight and overload during parachute opening in parachute device deign, a parachute system that can carry more load and reduce opening load at high speed in Mars exploration is presented for the development of application requirements.

Reefing system can effectively reduce the opening load of parachute and improve stability. However, the reefing system is usually used for subsonic parachute deceleration, but has not been applied to the deep space exploration field in supersonic state. This paper studies the feasibility of the application of reefing technique in supersonic parachutes.

In this paper, the study on reefing system of supersonic parachute is carried out based on the disk-gap-band (DGB) parachute commonly used in Mars exploration. This paper uses the fluid-structure-interaction (FSI) simulation technology to study the DGB parachute: the aerodynamic characteristics of the parachute with reefing, such as drag, stability and opening load characteristics; the influence of the position of reefing system on parachute stability; the influence of the time to release the reefing line on the opening load of parachute. Additionally, the differences of aerodynamic performance of parachutes in the atmosphere of the earth and Mars, subsonic state and supersonic state is studied. Finally, the reefing design method suitable for the supersonic DGB parachute is obtained. All the efforts are to support the Mars exploration, especially for the design of reefing system of supersonic DGB parachute.