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RESEARCH ON INFLATABLE DECELERATION SYSTEM FOR DEEP SPACE EXPLORATION

Abstract

For sample return missions in the deep space exploration, the engineers take a lot of efforts to design a large reentry vehicle which carries the sample. However, the size of the reentry vehicle usually is restricted by the payload bay of the launch vehicle. Inflatable reentry and descent technology (IRDT), which is a new space reentry and recovery technology, has attracted great attention in recent years, as its aerodynamic performance is significantly better than traditional parachutes, and it has the advantage that can effectively reduce the structural weight, volume and cost. The inflatable deceleration system uses inflation to expand the flexible structure of the folding package, thereby increasing the resistance area to achieve the purpose of deceleration. If it is regarded as a completely rigid structure which is not feasible, it is important to consider the impact of aeroelasticity on its flight performance.

In this paper, the inflatable deceleration system is carried out based on the inflatable cone. The fluid-structure-interaction (FSI) simulation is applied to investigate the aerodynamic performance of the inflatable cone and analyze the effects of elastic deformation on the drag, stability and dynamic characteristics of the inflatable deceleration system. In addition, the aerodynamic performances of the inflatable deceleration system in different atmospheric environments of Earth atmosphere and Mars atmosphere, as well as carrying different size payload capsules, are also investigated. All the efforts are to support the design of inflatable deceleration systems for deep space exploration.