64th International Astronautical Congress 2013

Paper ID: 17433
oral

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

Author: Dr. Vsevolod Koryanov
Bauman Moscow State Technical University, Russian Federation, vkoryanov@mail.ru

RESEARCH OF THE DYNAMICS MOTION OF LANDING VEHICLE WITH INFLATABLE BRAKING DEVICE IN THE PLANET ATMOSPHERE

Abstract

The purpose of this paper is to analyze the dynamics of the angular motion of a landing vehicle with an inflatable braking device at the final stage of the movement of space re-entry vehicles in the atmosphere. To solve the problem of descent landing vehicle on the surface of the planet requires the use of different kinds of braking devices. The advantage of inflatable braking device is that you can use on the atmospheric the descent from hypersonic speeds and ending subsonic. During the movement of the planet's atmosphere landing vehicle with such device subjected to considerable aerodynamic stresses, resulting in modification of a non-rigid shell inflatable braking device and the emergence of the current asymmetries. To achieve this purpose, we propose methodology in which the analysis of the influence of strain inflatable braking device on the dynamics of angular motion of the landing vehicle in the planet's atmosphere, which includes: 1. Assessing the impact of the main deformation inflatable braking device on the dynamics of angular motion of the landing vehicle in the upper atmosphere of the planet. 2. Assessing the impact of deformation inflatable braking device on the dynamics of angular motion descent with an inflatable braking device at resonance. 3. Assessing the impact of deformation inflatable braking device on the dynamics of angular motion landing vehicle with an inflatable braking device on the target, subsonic phase. In the report are the following results: 1. From these calculations, it is seen that the deformation of inflatable braking device changes the values of the aerodynamic force and moment coefficients, as well as to additional small asymmetry in the form of lateral displacement of the center of mass of inertia and the shape asymmetry. 2. The asymmetry of the external shape of the inflatable braking device during its deformation can lead to significant values of the coefficient of aerodynamic asymmetry. This in turn causes a change in the dynamics of angular motion landing vehicle. Based on these results, we can conclude the following: 1. These results allow the simulation in the design phase to determine the required lateral stiffness of the inflatable braking device, which provides a stable motion of various space landing vehicles on the entire trajectory of descent. As a result of this work has been developed the software required for settlement.