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ANALYSIS OF THE INFLUENCE OF SMALL ASYMMETRIES IN THE DYNAMICS OF MOTION OF SPACE LANDING VEHICLE IN CONDITIONS OF RESONANCE WITH APPLICATION SPECIAL AEROELASTIC BRAKING DEVICES

Abstract

Implementation of task the descent of the landing vehicle on the surface of the celestial body requires the use of various types of braking devices. To carry out landing is proposed to use special aeroelastic braking devices that allow a "soft" landing of the landing vehicle on the surface of the planet without the use of a parachute system. To ensure the passive stabilization of the landing vehicle is still on the atmospheric flight phase is deployed Aeroelastic inflatable braking device and landing vegicle together with the braking device is twisted around its longitudinal axis. In previous author papers were considered in detail the methods for calculating the angular motion space landing vehicles with aeroelastic inflatable braking device in accordance with the described methods was considered dynamics of the motion of the landing vehicle to the planet's atmosphere, and it was also investigated the effects of wind on the dynamics of the angular motion of the landing vehicle with a aeroelastic braking device on the final trajectory. In this paper present an analytical methodology for assessing the impact of small asymmetries in the deflection longitudinal axis of the space landing vehicle from the velocity vector in a resonance mode of motion. The methodology allows to analyze the value of the design parameters and the aerodynamic coefficients on the degree of their influence through the asymmetry of a deviation from the longitudinal axis of the landing vehicle velocity vector. Calculations of the angular motion parameters of the landing vehicle made using the methodology developed by the author based on the assumptions that the rapid development of resonance modes of motion and that the deformation of the aeroelastic inflatable braking device takes place in the spatial angle of attack plane. It is shown that the main factor causing the change in the angular motion parameters of the landing vehicle after passing moment of resonance is the asymmetry of the external shape and size of the velocity head. Depending on the lateral stiffness of aeroelastic inflatable braking device values of the aerodynamic coefficient moment can reach such values that are strongly influenced by the dynamics of the angular motion of the landing vehicle. In some cases, the spatial angle of attack reaches such values that the motion of the landing vehicle with aeroelastic inflatable braking device becomes not stable.