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

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CHOICE OF SEPARATION PARAMETERS FROM A PLATFORM COMMITS UNDIRECTED
MOVEMENT FOR GROUP OF NANOSATELLITES

Abstract

Orbital stages of launch vehicles can used as a platform for the piggy back orbiting of cluster of nanosatellites. The program of the nanosatellites separation from an orbital stage must realized safe nanosatellites movement after their group deployment. Due to the fact that after separation of the main payload, the orbital stage obtains the angular velocity, the value and direction of which are random, the direction of an each nanosatellite after separation will be random, too. As orbital stages are launched as usual on low altitude the atmosphere influences are very strong for relative motion. In this regard, the task of choosing the separation parameters for each nanosatellite (the velocity and time of separation) from conditions to prevent a collision with the orbital stage, the main payload, and also with each other (safe motion terms) is very important. If nanosatellites separation is implemented for future formation flight it is required to the keep a certain distance between nanosatellites, the parameters of separations should be chosen on conditions of reducing the removal of nanosatellites one from each other (maximum distance between nanosatellites have to be no more than specified distance during two orbits). Such parameters of separation will allow to save the energy expended on keeping the integrity of nanosatellites group. Thus, the safe motion and maximum distance terms impose limitations on the choice of nanosatellites separation parameters. It was made a statistical research which have allowed to develop a method for selecting parameters of nanosatellites separation (the velocity and time of separation). Those parameters exclude the possibility of nanosatellites collision and to reduce the removal of one from each other no more than predetermined distance. The developed method is applicable for determining the parameters of nanosatellites separation from the orbital stage or from any space platform moving with random precession. The research was made on an example of nanosatellites separation from the carrier rocket "Soyuz" orbital stage taking into account the random nature of its orientation after separation of main payload. The research was supported by the Ministry of Education and Science of the Russian Federation (project No. 9.1421.2014/K).