Calculation of orbital tether system design parameters for the implementing atmospheric braking device functions

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The article considers the project of using the orbital tether system as an atmospheric braking device for deorbiting small spacecrafts (including nanosatellites) from low-altitude orbits. The terminal elements of the tether system are two parts of the worked-out spacecraft enhancing the effect of gravitational stabilization of the tether system, and the connecting tether significantly increases the overall aerodynamic drag and plays the role of an aerodynamic brake. The mathematical model of the motion of bound objects in the central Newtonian terrestrial gravitational field is developed, taking into account the aerodynamic drag force of the atmosphere upper layers and the mass of the tether. The forms of equilibrium of the cosmic tether in the equilibrium stationary regime of the bundle motion are determined. A methodology for calculating the basic design parameters of a tether system deployed on the basis of a nanosatellite and performing the functions of an atmospheric braking device is developed. The analysis of the possibility of implementing the function of the atmospheric braking device by the tether system on elliptical orbits is performed. The recommendations on the design of tether systems performing the functions of atmospheric braking devices are formulated.

Keywords: *orbital tether system, nanosatellite, aerodynamic drag force, atmospheric braking device, equilibrium stationary regime, debris removal*

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