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Author: Dr. Vera Mayorova
Bauman Moscow State Technical University, Russian Federation

Mr. Stepan Tenenbaum
Bauman Moscow State Technical University, Russian Federation
Mr. Dmitry Rachkin
Bauman Moscow State Technical University, Russian Federation
Mr. Oleg Kotsur
Bauman Moscow State Technical University, Russian Federation
Ms. Valeriia Melnikova
Bauman Moscow State Technical University, Russian Federation
Mr. Dmitry Romanenko
Bauman Moscow State Technical University, Russian Federation
Mr. Kirill Frolov
Bauman Moscow State Technical University, Russian Federation
Ms. Veronika Pavlyuchenko
Bauman Moscow State Technical University, Russian Federation
Ms. Victoria Goryunova
Bauman Moscow State Technical University, Russian Federation
Ms. Adelina Gataulina
Bauman Moscow State Technical University, Russian Federation

ROTARY SOLAR SAIL FOR NANOSATELLITE CONSTELLATION FORMATION

Abstract

One of the most relevant trends in nanosatellite technologies development is constellation formation and it providing its sustainability. In order the project we propose to use a unit with a two-blade rotary solar sail for low Earth orbit nanosatellite constellation formation.

We developed an original algorithm for constellation formation based on alternate folding and unfolding of the sail, which is integrated into each satellite of the constellation.

A large number of ballistic simulations was carried out and confirmed the technical feasibility of this technology. During the calculations, the following time for constellation formation dependencies were identified: from the height and inclination of the initial orbit, from the number of nanosatellites in the constellation; from the area of the solar sail. Various cases of the orientation of the solar sail were also considered.

Moreover, we designed the unified Solar Sail unit for the CubeSat, produced its fully functional mock-up and made the experiment of the sail deploying due to centrifugal forces during rotation in the vacuum chamber.

The research results became the basis of the project of creating a real nanosatellites system for Sun observation that is planned to launch in 2020.