

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Engineering - Methods, Processes and Tools (2) (4B)

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SOLAR ARRAYS WORK DURING DYNAMICAL OPERATIONS: MODELING AND OPTIMIZATION
PROBLEMS RELATED TO MASSIVE SPACECRAFTS FLIGHT

Abstract

The report is devoted to modeling the operation of solar panels of a massive spacecraft (inspired by "Nauka" ("Science") module of the International Space Station) during an autonomous flight, including during the modes of uncontrolled rotational motion (spin in the Sun). The purpose of the simulation is both the actual production forecast and the study of the stability of the spin mode depending on the selected perturbation model. The task, therefore, is complex, and includes at least the following aspects:

- Simulation of the perturbed translational and rotational motion of the spacecraft,
- Modeling of shading of the surface of solar panels and power generation,
- Analysis of "spin stability markers", primarily the angle between the normal to the surface of solar panels and the direction to the Sun.

What is more, kinematical and dynamical Euler equations allows us to consider optimizations problems related to the "better" solar angle, "better" stability of satellite rotation etc.

The modeling tool is the space missions interactive simulation environment MIDE (Missions Integrated Development Environment), developed at the Faculty of Space Research of Lomonosov Moscow State University, which provides functionality for the layout of the virtual world from objects moving in selected coordinate systems in accordance with specified models, as well as for the formation and analysis of reports on the evolution of object properties over time.

The report provides examples of calculations carried out during the withdrawal of the massive module, including power production with light reflected from Earth. It is assumed that the experience gained can be applied in the tasks of complex modeling of the operation of spacecraft systems during various operating modes and in the presence of the influence of various factors of outer space.