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Risk Management for Safety and Quality in Space Programs (1)

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LAUNCHER MISSION RISK REDUCTION WITH ADVANCED ADAPTIVE GUIDANCE ALGORITHMS

Abstract

The possibility to reduce the space transport system (STS) injection risk by the further development of the terminal guidance system is under consideration. The new generation of the adaptive guidance algorithms (AGA) is proposed for the control systems (CS) to solve the problems in real-time through the optimization of branching STS trajectories, aimed at the maximizing the trajectory controllability domain. As a result, the performance of the STS flight mission is provided for the widest possible range of disturbances and failures.

AGA can be used both in forming the STS nominal trajectories control programs and for trajectory perturbations correction in real time. This unification allows the significant time reduction of flight mission development and the better adjustment to the actual start-up conditions.

The efficiency of the proposed approach to improve STS tolerance to various perturbations is demonstrated by extensive modeling the injection procedures of modern space launchers (SL).

The importance of the AGA implementation to reduce STS injection risks is clearly revealed by the case of the "Proton-M" SL accident in December 5, 2010, resulted in the loss of three GLONASS satellites. The cause of the accident was recognized as a fueling error of the SL upper stage. Here are considered possibilities in such a situation of the implementing the flight mission in full or in part with the use of AGA.