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LYAPUNOV CONTROL FOR ATTITUDE MANEUVERS WITH RESTRICTED AREAS

Abstract

Lapunov-based attitude control algorithms offer good accuracy and robustness of the attitude control. In addition, they are rather simple and can be easily implemented on-board the satellite. On the other hand, these algorithms have some peculiarities: they usually do not take into account the limitations that are imposed either on the attitude (presence of restricted attitudes, i.e. keep-out cones) or on the attitude control system (limited control torque). In present paper we propose an approach that allow us to solve these problems.

The optimal control algorithms can be used for the rest-to-rest slew maneuver performing in the case of restricted areas presence. Unfortunately, it usually requires much computational time. Though there are some techniques that allow reducing of this time, e.g. the particle swarm optimization, it still can be hardly applied for a real time attitude control. On the other hand, modification of Lyapunov-based control law, which is similar to the potential barrier, is able to ensure the maneuver performing and restricted area avoidance in real time.

Another problem to be discussed is the transient motion under the Lyapunov-based control law. There is no limitations imposed on relative angular velocity, thus the control torque is also unbounded. It is shown that there is a modification of Lypunov-based control law that ensures the reference attitude motion tracking and bounded relative angular velocity. Hence, the limited control torque can be taken into account during control law synthesis.