

Spacecraft Reorientation planning with attitude constraints based on B-spline quaternion curves

There are many cases where a spacecraft needs to perform reorientation maneuvers during its mission. Reorientation maneuvers of a spacecraft are usually constrained. One example is that the antenna of the spacecraft is required to keep pointing towards one specific direction, such as the direction of the ground station on Earth, for the purpose of communication. Another example would be that the telescope on board the spacecraft is not allowed to point to the bright objects in the space otherwise the sensitive instrument will be damaged.

The topic of this thesis is to investigate the rotation planning for spacecraft with attitude constraints. In this work, quaternion is chosen to represent the attitude of spacecraft. The basic idea is to use B-spline quaternion curves to plan the constrained reorientation motion of spacecraft.

In detail the following tasks have to be performed:

1. To do Literature review of spacecraft reorientation control or planning with attitude constraints
2. To develop the algorithm for planning rotation trajectory based on B-spline quaternion curves
3. To simulate and verify the algorithm with Matlab
4. To write the thesis

Recommended References

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[3] Boyarko, George A., Marcello Romano, and Oleg A. Yakimenko. "Time-optimal reorientation of a spacecraft using an inverse dynamics optimization method." Journal of Guidance Control and Dynamics 34.4 (2011): 1197.

[4] Pan, Jia, Liangjun Zhang, and Dinesh Manocha. "Fast smoothing of motion planning trajectories using b-splines." In *Robotics: Science and Systems*. 2011.