Paper ID: 65914
oral
student

IAF ASTRODYNAMICS SYMPOSIUM (C1)
Attitude Dynamics (2) (9)

Author: Mr. ning cao
National Key Laboratory of Aerospace Flight Dynamics,Northwestern Polytechnical University,Xi'an,China, China, caoningss@163.com

Prof. Weihua Ma
National Key Laboratory of Aerospace Flight Dynamics,Northwestern Polytechnical University,Xi'an, China, whma_npu@nwpu.edu.cn
Mr. Shuang Wei
National Key Laboratory of Aerospace Flight Dynamics,Northwestern Polytechnical University, China, 1393268102@qq.com
Mr. Haodong Meng
National Key Laboratory of Aerospace Flight Dynamics,Northwestern Polytechnical University,Xi'an, China, 897519717@qq.com

ATTITUDE CONTROL OF UNDER-ACTUATED SATELLITE FOR GROUND MOVING TARGET ORIENTATION

Abstract

In the satellite with reaction flywheel as the attitude control actuator, the three-axis stability control is often unable to be implemented due to the failure of the flywheel, and some flywheels have speed constraints due to their working characteristics, which leads to the under-actuated attitude control mode of the satellite. Conventional tasks require under-actuated attitude control to ensure that the target points to an inertial vector in space. However, some tasks require satellites to point to the ground station to maintain communication, which puts forward new requirements for under-actuated attitude control. Therefore, it is significant to study the satellite attitude under-actuated control for tracking ground station. In this paper, the under-actuated control algorithm is discussed to solve the problem of the dual reaction flywheel, which can realize the pointing stability control and the orientation to the ground of a ground station by the satellite load line of sight (Z-axis). Firstly, according to the satellite position information, velocity information and ground station motion information, the desired attitude of the satellite is specially planned. The normal direction of the plane composed of relative position and relative velocity is used as the orientation of a satellite's rotation axis, and the orientation of the ground station is used as the viewing axis (Z axis) of the satellite's load, so as to construct the desired attitude coordinate system. Secondly, the desired attitude angle is transformed into four dimensions. And the error quaternion and its differential term between the expected quaternion and the satellite attitude quaternion are also established. Then the error quaternion and its differential are PD controlled, and then the flywheel attitude dynamic model is used to realize the satellite attitude tracking control by introducing the flywheel saturation characteristics and the zero speed constraint. The simulation results show that the attitude motion planning method is reasonable, which can basically meet the under-actuated attitude control accuracy of two flywheels (1 deg and 0.01 deg / s), The algorithm is simple, easy to be applied in engineering and has practical significance.