

Interactive Presentations (IP)
Topic 2 - Interactive Presentations (2)

Author: Mr. Ma Chuanling
Beijing Aerospace Control Center (BACC), China, 297199905@qq.com

APPLICATION OF MOMENTUM WHEEL UNLOADING IN MAINTAINING MISSION ORBIT
CONFIGURATION OF CHANG'E-4 RELAY SATELLITE

Abstract

The mission orbit of Chang'e-4 relay satellite is a halo orbit, which is unstable and has a running time of several years. It needs to be maintained and controlled regularly to maintain the orbit configuration. Due to the installation asymmetry of the relay satellite structure in the main body axis and the influence of solar light pressure, in order to ensure the relay direction, the momentum wheel needs to constantly absorb the external interference torque to maintain the attitude stability, resulting in the acceleration of the momentum wheel speed, after reaching a certain threshold, the angular momentum unloading is required, and the relay satellite attitude control engine will start. During the unloading, there will be additional speed increment along the satellite axis, which will cause unexpected disturbance to the orbit. Moreover, due to the distance between the satellite's center of mass and the sun's pressure center, the interference torque of the pressure is large, the momentum wheel unloading is frequent, and the speed error caused by the attitude control engine jet unloading will be exponentially enlarged, which will aggravate the satellite's departure from the mission orbit, or even fly away from the L2 point, and change the period of mission orbit-keeping. Therefore, it is necessary to consider the influence of satellite jet unloading reasonably when designing the mission orbit configuration keeping strategy, otherwise the problem of shorten expected orbit-keeping period and frequent control will occur. In this paper, based on the analysis of engineering measured data, the cumulative law of satellite angular momentum and the influence of momentum wheel unloading on mission orbit configuration are analyzed. An empirical model of the change of unloading angular momentum and the equivalent velocity increment of jet is established. A method of maintaining mission orbit configuration of relay satellite based on momentum wheel forcible unloading is proposed. Under certain constraints, by adjusting the deflection angle of attitude control engine jet unloading, the configuration of mission orbit can be improved while the angular momentum unloading, the control period of orbit maintenance can be prolonged and the propellant can be saved. The results of engineering application verify the validity of the method.