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A HIGH EFFICIENT ATTITUDE REFERENCE POINTING LAW FOR CHINESE "EINSTEIN PROBE" SATELLITE

Abstract

The "Einstein probe (EP)" is a scientific satellite to discover the extremely dramatic celestial bodies and events in the universe, which is proposed by Chinese Academy of Sciences. In order to achieve the scientific goals, the payloads of the EP include a wide field of view of X-ray telescope (WXT) and a following-up observation X-ray telescope (FXT), the goal of WXT is to implement a full-day monitoring to achieve triggering and localization of X-ray transient sources/outbreak sources, while the FXT is used for deep observation of the trigger source, the opportunity target, and high sensitivity celestial survey. Considering the requirement of observation duration and the illumination constraint, the attitude reference pointing law is designed based on the time of anti-subsolar, and the sun vector is constrained in second quadrant in the XOZ plane of the satellite body frame so that the –Z direction can be used as heat dissipation surface. The satellite orbit is divided into four parts based on the time of anti-subsolar in each orbit, the core part is the duration when the satellite is at the umbra of the Earth, which is named part II. In this part, the satellite is designed pointing to the right ascension of anti-subsolar point, and the declination is determined by the field of view of WXT in order to cover the declination range of -90 to 90 degree in the observation cycle of three orbits. The part I is the time interval from the point at which the satellite flies away the subsolar point to the start of part II. While the part III is the time interval from the end of the part II to the point when the satellite enters the light region. In part I and part III, the observation point of the declination is the same, while the right ascension is 120 degrees apart, twice of the field of view of WXT. Part IV is the duration when the satellite is around the subsolar point, the payload points to the Earth to void the sunlight in part IV. The attitude maneuvers between each part is obtained by spherical linear interpolation. The simulation results obtained by STK show that the attitude reference pointing law can ensure WXT covering half of the celestial sphere in three orbits, and the total

celestial sphere is covered in half a year, which can satisfy the requirement of the scientific observation.