SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

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A PRECISE SPACE-BAESD DETECTION AND TRACKING SYSTEM FOR SPACE DEBRIS

Abstract

To detect and track space debris, space-based optical surveillance system boasts unique advantages comparing with ground facilities. By using a telescope on a satellite, the effect of atmosphere is eliminated and the viewing distance is much closer so that higher sensitivity can be achieved and imaging space objects becomes possible. Based on this, we proposed a precise solution for space debris detection and tracking by using a microsatellite platform with a 20cm aperture CMOS camera comprised of 2064X2064 pixels with a 7m pitch. The whole weight budget is less than 120kg. It has two working mode: Detecting Mode and Track Mode. In detecting mode, the camera will be staring imaging the same patch of the sky for as long as 60 seconds. Therefore, the stars become a fixed coordinate system while space debris will leave a streak on it. Once a desired space debris is detected, the camera will switch into tracking mode automatically. It will track the debris at angular rates up to 60 arcsec/s for 30 seconds for collecting images of the space debris. Inspired by laser Acquisition, Tracking, and Pointing (APT) technology, Compound axis control is introduced in order to achieve the high tracking precision in the scheme. For tracking space debris, the active attitude control plays as the coarse tracking assembly (CTA), which will keep the object inside the control range of the fine tracking assembly (FTA). And a high frequency piezo tip/tilt mirror is used for the FTA. With a sampling rate of 60Hz, the tip/tilt mirror servo controller uses the object's motion on a sequence of images as a feedback to compensate low frequency vibration and the attitude control error. Algorithm which is used for coordinating the CTA and FTA plays the key role in precision control. By proper configuration of the compound control system, the pointing accuracy can be less than 1 arcsec. In this paper, Methods including optical imaging simulation for satellite pointing, error measurement and image restoration are also introduced.