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OPTIMIZATION-BASED TELESCOPE PASSIVE AUTO-FOCUSING THROUGH IMAGE QUALITY ASSESSMENT FOR THAI NATIONAL SPACE OBJECT OBSERVATION

Abstract

In recent years, the growing of orbital debris in the Resident of Space Objects (RSOs) could be a serious issue for operational spacecraft and manned spaceflight. To prevent debris-related risks in operational orbit, ground-based passive optical telescope was used as fundamental imaging sensor for Space Situation Awareness to periodically maintain the orbital parameters of space object in RSOs through an astrometry engineering approach. In the case of small and dim space object with low contrast images and suffering from a lack of sharpness are easily influenced by background interference. Normally, a manual adjustment of a preliminary focus range of telescope is one of the drudgery practices that astronomers constantly face to give the high-contrast image capturing before beginning a tracking procedure. Therefore, the passive automatic focusing process was initially required for a robotic telescope as a function of image quality assessment. Technically, the auto-focusing is a combination of processes between software and motorized focusing hardware with position feedback. In this paper, we investigate a new approach and software for passive automatically focusing charge-coupled device based telescope systems for finding a focal-point of an imaging system that minimizes objectives while satisfying constraints. It is greatly appropriate for unobserved all-night telescope operations as an asteroid and/or orbital debris monitoring. Based on the image quality assessment as a function of Full-Width Half Maximum was basically applied, the auto-focusing algorithm of the telescope system was realized via the golden section optimizer through the least square method. The experimental results obtained during the commissioning of an alt-azimuth

mounting equipped with a 0.7-meter optical aperture telescope from two observation sites of National Astronomical Research Institute of Thailand. There were used to demonstrate with two state of the art methods for presenting method efficiency. Final results denote that the presented proposed algorithm improves the quality of the image contrast and can provide more clear details and information.

Keywords: Space Situation Awareness, Auto-focusing, Image quality assessment, Least-square method, Optimization.