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HIGH RESOLUTION MULTI-FUNCTIONAL OPTICAL PAYLOAD DESIGN FOR LIANLI MICRO SATELLITE

Abstract

Lianli satellite is a 20kg class high micro satellite equipped a high-resolution optical payload, which has functions of acquiring panchromatic and multi-spectral push-broom images and staring video. The design and optimization of the payload with 0.98m GSD are introduced, aiming to achieve high-quality optical remote sensing using micro satellites. This design uses the layout of a coaxial two-mirror reflective system to achieve compactness and high resolution, which is difficult for conventional camera. In view of the increase of tolerance sensitivity and aberration caused by the pursuit of volume compression, based on aberration theory and Monte Carlo method, reasonable design of the correction mirror set and analysis of tolerance sensitivity are applied, the secondary spectrum aberration well corrected. In order to enhance the radiometric quality of remote sensing images, analysis and improvements are made on the design of the optical system's baffles without increasing the size, by taking PST as evaluation index. This design solves the problems of compact optical system susceptible to stray light interference, poor tolerance sensitivity and radiation quality degradation, and achieves long focal length and large field of view. With the compact optical design, the total length of the payload is compressed to only 190 mm, while the total mass is only 3.19kg. The electronic and embedded software design of the payload are also introduced for this multi-functional payload. A low noise global shutter CMOS focal plane detector are applied, with a digital domain time delay integrated push-broom technology, while compatible with the area-array exposure working mode. An advance onboard artificial intelligent processing is also adopted in the satellite for in-orbit ground scene recognition.