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IMAGE QUALITY ENHANCEMENT AND VERIFICATION OF SUPERVIEW-1 COMMERCIAL REMOTE SENSING CAMERA

Abstract

SuperView-1 is China's first 0.5m-level high-resolution commercial remote sensing camera. Several improvements are proposed in this paper for radiometric and geometrical quality enhancement under user-defined but critical weight and size constraint. Considering radiometric quality, we focused on Signal Noise Ratio (SNR) and Modulation Transfer Function (MTF) design. High precision Loop Heat Pipe (LHP) is adopted to keep the Time Delay Integration Charge Coupled Device (TDICCD) sensor operating under stable and low temperature, which reducing the dark current level and volatility. Additionally, Multi-stages time delay integration and dedicated sample points selection of Correlated Double Sampling (CDS) are used to decrease the circuit noise. The fixed pattern noise is statistically analyzed in the lab and then removed by onboard processor in real time. Since the MTF performance is generally evaluated as a systematic parameter from satellite to ground, here we do not limit the traditionally static MTF at high value to alleviate the system develop difficulty. However, Modulation Transfer Function Compensation (MTFC) algorithm is applied to improve the final MTF value of the received images on the ground station accordingly. To the geometrical quality, interior orientation elements stability is achieved by dedicated design of reflection mirror and its supporting structure, and indirect high precision thermal control for opto-mechanical structure. Three star sensor brackets are directly mounted on the primary camera structures, meanwhile, the interface of which is specially designed to keep the stability of exterior orientation elements. The in-orbit commissioning has demonstrated that the remote images are bright and rich in texture. Besides, the positioning accuracy without ground control point reached 6 to 7 meters (1σ). In short, the in-orbit results demonstrate the effectiveness of the approaches proposed.