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MICRO APS CMOS STAR TRACKER AND ITS KEY TECHNIQUES RESEARCH

Abstract

As the detector used in star tracker, the APS CMOS technique has the advantages on rad-hardness, integrate circuit level and power consumption as star tracker detector comparing with the CCD, yet it has the insufficiencies on sensitivity and noise level. The sensitivity and noise property of APS CMOS as the detector of star tracker are detailedly analyzed in this paper. Meanwhile, the energy correlation filter algorithm was proposed according to the point spread function of the star tracker optical system. This algorithm does not only guarantee the star point centroiding accuracybut also improves the signal to noise ratio (SNR) to 2.5 times. To enhance the processing speed of image in the star tracker, the Run Length Encoding stars points information extraction algorithm based on the FPGA-DPRAM-DSP hardware structure was proposed. Considering that there's not much efficient information in the star image of the star tracker, this algorithm disassembles and optimizes the three phases: run length sweep, run length encoding and run length combination in original Run Length Encoding algorithm and make it suitable to the pipeline processing structure with the star image acquirement and star image filter. This algorithm has the advantage that it need less RAM and get higher speed. Finally, the star tracker laboratory test experiment and real night sky experiment were brought forward and designed in this paper. Through the two experiments, key technical goals including sensitivity, star identification and accuracy of the APS CMOS star tracker prototype were validated.