

机械拼接时间延迟积分CCD空间相机的振动参数检测

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Vibration parameter measurement of TDICCD space camera with mechanical assembly

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摘要 图/表 参考文献 相关文章 (15)

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摘要 为了获取空间相机在轨拍摄期间的振动幅频特性,提出了一种基于TDICCD拼接技术的空间相机振动参数检测方法。根据TDICCD拼接原理,利用拼接结构中的重叠成像区域在不同时刻对同一景象成像,通过灰度投影算法对所成图像进行比对求得相对偏移量,拟合偏移量数据,进而根据拟合结果计算出空间相机振动参数。实验结果表明:对于一维单一频率的振动,频率相对误差小于0.5%,振幅绝对误差小于1个像素;对于一维混合频率的振动,频率相对误差小于3%,振幅绝对误差小于2个像素;对于沿推扫方向和垂直推扫方向均为单频振动的二维振动,频率相对误差小于1%,振幅绝对误差小于2个像素。实验结果验证了检测方法的正确性,达到了不增加额外设施,仅利用相机自身结构就能精确测量相机振动参数的目的,并为后续图像复原提供了数据基础。

关键词 : 空间相机, 时间延迟积分(TDI)CCD, 机械拼接, 振动参数, 灰度投影, 曲线拟合

Abstract : To obtain the vibration amplitude-frequency characteristics of a in-orbit space camera, a space camera vibration parameter detection method by using TDICCD mechanical assembly technique was presented. According to TDICCD mechanical assembly technology, the images of same scene were taken by a TDICCD overlapping area at different moments, then the images were compared by using gray projection algorithm to derive the relative offset. Finally, the offset data were fitted, and the vibration parameters of the space camera were obtained according to the fitting result. Experimental results show that frequency measurement relative error and the amplitude measurement absolute error are less than 0.5% and 1 pixel respectively for the one dimensional single frequency vibration; and those are less than 3% and 2 pixel respectively for one dimensional mixed frequency vibration. Moreover, for two dimensional vibration which are both single frequency vibration along and vertical to the scanning direction, the frequency measurement error and the amplitude measurement error are less than 1% and 2 pixel, respectively. Experimental results demonstrate the correctness of detection methods, reach the purpose of detecting vibration parameters without additional facilities except the camera structure, and provide a data base for the subsequent image restoration.

Key words : space camera Time-delay Integration CCD(TDICCD) mechanical assembly vibration parameter gray projection algorithm curve fitting

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