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宽动态范围红外测量系统的快速非均匀性校正

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Fast non-uniformity correction for high dynamic infrared radiometric system

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摘要 宽动态范围的红外辐射特性测量系统往往预设多个积分时间档位,并对每个积分时间逐一进行非均匀性校正。本文研究了不同积分时间下非均匀性校正系数有的差异问题,基于黑体定标法和积分时间法提出了新的非均匀性校正方法。该方法只需要得到两个积分时间和两个定标温度点即可得到全动态范围所有积分时间下的非线性校正系数,可在保证校正精度的同时减少辐射源温度点,降低校正时间。使用某Φ400 mm口径的地基红外辐射特性测量系统对该方法进行了验证。结果表明,采用本文方法后图像的非均匀性由3.78%减小到0.24%。由4 ms下的校正数据可知,得到的校正结果接近直接用该积分时间进行校正的精度。提出的方法简化了所需设备,降低了校正时间,具有实时性强、精度高等特点,适用于外场测量。

关键词 : 制冷型红外探测器, 辐射测量术, 动态范围, 积分时间, 非均匀性校正

Abstract : Several different integration time steps are often required for a high dynamic infrared radiometric system, therefore, its non-uniformity is usually corrected one by one. As there are different correction coefficients in different time, this paper proposes a new non-uniformity correction method based on blackbody calibration method and integration time calibration method.The method obtains nonlinear correction coefficients of all integration time in whole dynamic ranges only by two integration time steps and two calibration temperature points, meanwhile keeping correction accuracy, reducing measuring temperature points and correction time. The verifying experiments for the proposed method are performed by using a Φ400 mm ground-based infrared radiometric system.The results show that the uniformity has reduced from 3.78% to 0.24% by using the proposed method. In addition, the result at 4 ms integration time illustrates that this method has a higher precision. Moreover, it greatly reduces the required equipment and correction time,and is characterized by good real-time performance and suitable for field measurements.

Key words : cooled infrared detector radiometry dynamic range integration time non-uniformity correction

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