

论文

640×512制冷探测器非线性响应分析

刘宁,陈钱,顾国华,隋修宝

(南京理工大学 电子工程与光电技术学院 光电技术系|近程高速目标探测技术国防重点学科实验室,南京 210094)

摘要:

由于制冷探测器焦平面制作工艺的缺陷,使其各部分组分不会完全相同,从而导致焦平面在进行光电转换时各个位置的光电流大小存在差异.本文以国产640×512中波凝视型制冷热像仪整机研制项目为基础,通过对探测器接收红外辐射并转换为光电流的过程中主要参量与焦平面材料Hg_{1-x}CdxTe中组分x的关系进行分析,推导出探测器焦平面光电流与组分x的关系模型.在探测器能够正常工作的宽温度范围内利用黑体面源对探测器进行照射,采集各个温度点下探测器输出数据,并对本探测器整体响应特性及单个像素点的响应特性进行分析.根据影响光电流的最主要的参量变化情况,提出了双指数曲线模型来描述实际响应数据,并通过大量的数据和图表分析,证明了该模型能够提高对探测器实际响应描述的精确程度,对实际的工程应用具有指导意义.

关键词: 制冷探测器 非线性 双指数曲线拟合 掺杂组分

Analysis of the Nonlinearity of Cooled Infrared Detector

LIU Ning, CHEN Qian, GU Guo-hua, SUI Xiu-bao

(Department of Optics and Electronics|Ministerial Key Laboratory of JGMT, School of Electronic Engineering and Optoelectronic Techniques, Nanjing University of Science and Technology, Nanjing 210094, China)

Abstract:

The compositions of each part on the focal plane array (FPA) are not likely the same because of the manufacture defects. The defects will cause the inherent differences between pixels while the focal plane array is conducting the photoelectronic conversion. This paper has derived the theoretical model of the nonlinearity of the cooled detector corresponding to the composition x, which is based on the research project of the domestic 640×512 MWIR cooled thermal imager. The infrared radiation received by the FPA and converted into photocurrent, this type of current has significant relationship with the nonlinearity of the detector according to the composition x in the Hg_{1-x}CdxTe material. A black body was used to radiate the detector under the wide working temperature of the detector, and amount of experimental data were collected under every pre-set temperature point. According to the parameter change that influence the photocurrent most, a double exponential fitting model was proposed to describe the nonlinearity characteristics of both the total response and the separate pixel response of the detector. Multiple works were carried out by analyzing the response data in the form of diagram and table to prove the accuracy of the real response fitting by this model.

Keywords: Cooled detector Nonlinearity Double exponential fitting Composition

收稿日期 2010-11-25 修回日期 2011-01-21 网络版发布日期 2011-06-25

DOI: 10.3788/gzxb20114006.0921

基金项目:

江苏省自然科学基金重点项目 (No. BK2008049) 资助

通讯作者: 陈钱 (1964-), 男, 教授, 博导, 主要研究方向为光电探测与图像处理, 光电信号处理与数字视频技术. Email: chenq@mail.njust.edu.cn

作者简介:

参考文献:

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF (590KB)
- ▶ HTML
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 制冷探测器
- ▶ 非线性
- ▶ 双指数曲线拟合
- ▶ 掺杂组分

本文作者相关文章

- ▶ 刘宁
- ▶ 隋修宝
- ▶ 陈钱
- ▶ 顾国华

- [1]QU Hui-ming,CHEN Qian.A theoretical model on infrared focal plane arraysbinary nonlinear nonuniformity[J]. Acta Electronica Sinica,2008,36(11): 2151-2153.
 屈惠明,陈钱.红外焦平面阵列二元非线性的非均匀性理论模型[J].电子学报,2008,36(11): 2151-2153.
- [2]JOHNSON J F.Hybrid infrared focal plane signal and noise model[J].IEEE Transcations on Electron Devices,1999,46(1): 96-108.
- [3]KARINS J P.Models of nonlinearities in focal plane arrays[C].SPIE,1992,1685(103): 103-109.
- [4]GAO Si-li,YU Yang,YANG Xin-yi.Simulation of nonlinear response of IRFPA[J].Infrared and Laser Engineering,2008,37(5): 770-772.
 高思丽,于洋,杨心溢.红外焦平面阵列非线性响应仿真[J].红外与激光工程,2008,37(5): 770-772.
- [5]BAJAJ J.State-of-the-art HgCdTe infrared device[C].SPIE,2000,3948(2000): 42-54.
- [6]HOUGEN C A.Model for infrared absorption and transmission of liquid-phase-epitaxy HgCdTe [J].Journal of Applied Physics,2002,66(13): 3763-3766.
- [7]GOPAL V.Model for response nonuniformity calculations of a direct-injection readout hybrid focal plane array[J].Optical Engineering,1994,33(3): 809-819.
- [8]FINKMAN E,SCHACHAM S E.The exponential optical absorption band tail of Hg_{1-x}CdxTe[J].Journal of Applied Physics,2004,56(31): 2896-2900.
- [9]GARDETTE H,ARRIETA E.Temporal noise prediction for cooled infrared photodiodes array [J].SPIE,2008,7100(28): 1-12.
- [10]FRIEDENBERG A,GOLDBLATT I.Nonuniformity two-point linear correction errors in infrared focal plane arrays[J].Optical Engineering,1998,37(4): 1251-1253.
- [11]MILTON A F,BARONE F R,KRUEER M R.Influence of nonuniformity on infrared focal plane array performance[J].Optical Engineering,1985,24(43): 855-862.
- [12]LIU Hui-tong,WANG Qi,ZHENG Zhi-wei,et al.Analysis and calculation of the nonlinear response in infrared focal plane arrays[J].Journal of Infrared and Millimeter Waves,2001,20(4): 253-258.
 刘会通,王琪,郑志伟,等.红外焦平面阵列非线性响应的分析和计算[J].红外与毫米波学报,2001,20(4): 253-258.

本刊中的类似文章

- 楚晓亮;张彬.超短脉冲在放大介质中传输特性研究[J].光子学报,2004,33(6): 641-644
- 袁明辉;张明德;孙小菡.偏振模色散对非线性光纤环镜微波光子开关的影响及其补偿[J].光子学报,2006,35(7): 1008-1012
- 蒋美萍;陈光;陈宪锋;沈小明;巢小刚;是度芳.含负折射率介质非线性Bragg腔的双稳态特性[J].光子学报,2006,35(4): 535-539
- 李文兵;赵国忠;王福合;周云松.半导体超晶格子带间跃迁光吸收理论研究[J].光子学报,2006,35(1): 61-64
- 吕翎;赵鸿雁;邹成业.单模激光Haken-Lorenz系统的振荡解析解[J].光子学报,2006,35(8): 1179-1182
- 姜其畅,苏艳丽,吉选芒.基于双光子光折变效应的非相干耦合灰光孤子族[J].光子学报,2011,40(4): 552-555
- 谭鹏 郭康贤 路洪.加偏置电场的双曲线量子阱中的光整流效应[J].光子学报,2007,36(5): 812-815
- 杨淑连.一种新型光纤压力传感器的设计[J].光子学报,2007,36(5): 838-841
- 王维江;肖万能;周金运.非线性光子晶体的单向透射性[J].光子学报,2007,36(3): 439-443
- 王超;李渭龙;唐轶凡;任兆玉;张崇辉;白晋涛.

基于ABCD矩阵的Z-扫描理论

- [J].光子学报,2007,36(3): 444-447
- 熊发田 欧阳娴 白永林 刘白玉.基于图像处理的条纹相机扫描非线性修正[J].光子学报,2009,38(4): 761-765
 - 张校逸 陈琦玮 邵钟浩.相敏光放大器对光纤偏振模色散进行补偿的探讨[J].光子学报,2007,36(5): 861-864
 - 陆司琦 宋英雄 林如俭.长距离光纤CATV系统中色散补偿位置的研究[J].光子学报,2009,38(3): 665-669
 - 汤炳书,沈廷根,王刚.C6v对称TIR-PCF结构参量对基模非线性系数的影响数值研究 [J].光子学报,2009,38(6): 1438-1441
 - 李国超,任谔,王新强,杨洪亮,陈经纬,蔡宁宁.适用于全光开关的[(C3H7)4N][Au(C3S5)2]三阶非线性光学性质研究[J].光子学报,2011,40(4): 547-551

文章评论 (请注意:本站实行文责自负,请不要发表与学术无关的内容!评论内容不代表本站观点.)

反馈人	<input type="text"/>	邮箱地址	<input type="text"/>
反馈标题	<input type="text"/>	验证码	<input type="text" value="6110"/>

