

光学计量与测试

基于优化电子散斑光谱的三维物体测量研究

王洪有;司新生

鹤壁职业技术学院,河南鹤壁458030

摘要:

用激光光束直接照射到测试表面,再用CCD采其变形前后表面散斑颗粒干涉形成的条纹,条纹图解析为测量点的位移量和变形量,进而得到其离面位移,在优化算法的时候采用n位相技术获取另一个n相移的变形条纹图像,将面内位移与离面位移分离,为了消除零级分量,让投影光栅移动1/2个周期。通过Matlab和四步位相算法给出了三维空间模型,得出变形后物体的离面位移数据。实验仿真数据表明其能够稳定地测量物体变形场三维分量,误差较低。

关键词: 电子散斑 三维 相移 测量

Three-dimensional body measurement based on optimized electron speckle spectrum

WANG Hong-you;Si Xin-sheng

Hebi Occupation Technology College, Hebi 458030, China

Abstract:

With laser beam directly radiated to the test surface, a CCD was used to pick up the fringes before and after its deformation due to speckle interference. These fringes were translated into the displacement and deformation components and its off surface displacement was obtained. In the optimized algorithm, n phase shift technology was adopted to obtain the fringe image of another n shift, which separated surface displacement with off surface displacement, the zero order component was removed and projection grating was move by a half period. A three-dimension space model was established through Matlab and four step phase algorithm. The experiment data indicated this solution could measure the three dimension deformation of the object accurately.

Keywords: electronic speckle three dimension phase-shift; measurement

收稿日期 修回日期 网络版发布日期

DOI:

基金项目:

通讯作者: 王洪有(1954-), 男, 河南鹤壁人, 河南鹤壁市鹤壁职业技术学院电子信息工程系高级讲师, 主要从事物理教学研究工作的。

作者简介:

作者Email: wapinetcn@yahoo.com.cn

参考文献:

[1] 于美文,张存林,杨永源.全息记录材料及其应用 [M].北京: 高等教育出版社, 1997.
 YU Mei-wen,ZHANG Cun-lin, YANG Yong-yuan. The total information recording material and applies [M]. Beijing: Higher Education Press, 1997.(in Chinese)

[2] 吴君君,宋伟,段晓飞.基于电子散斑干涉技术的圆度误差测量方法 [J]. 激光杂志, 2009,2: 51-52.
 WU Jun-jun, SONG Wei, DUAN Xiao-fei. Method of measuring roundness error based on ESPI [J]. Laser Journal, 2009,2: 51-52.(in Chinese with an English abstract)

[3] 马志芳,高秀梅,孙平.基于迈克尔逊干涉的傅里叶变换散斑形貌测量技术 [J].应用光学,2008,29(6):874-877.
 MA Zhi-fang, GAO Xiu-mei, SUN Ping. Fourier-transform speckle profilometry based on Michelson interference [J]. Journal of Applied Optics, 2008,29(6):874-877.(in Chinese with an English abstract)

[4] 孙平.单幅对称变形相位图分离二维变形分量的相移电子散斑干涉技术 [J].光子学报,2008,37(2): 337-339.

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(1187KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 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

- ▶ 电子散斑
- ▶ 三维
- ▶ 相移
- ▶ 测量

本文作者相关文章

- ▶ 王洪有
- ▶ 司新生

PubMed

- ▶ Article by Wang, H.Y.
- ▶ Article by Si, X. S.

SUN Ping. Isolation of two dimensional displacement components of symmetrical deformation by using one phase map in phase-shifting electronic speckle pattern interferometry [J]. Acta Photonica Sinica, 2008, 37(2): 337-339. (in Chinese with an English abstract)

[5] 宋凡峰, 王开福, 郑蓝. 电子散斑相位检测的滤波方法研究 [J]. 激光杂志, 2007, 28(3): 50-51.

SONG Fan-feng, WANG Kai-fu, ZHENG Lan. Investigation of filtering method for phase measurement in electronic speckle pattern interferometry (ESPI) [J]. Laser Journal, 2007, 28(3): 50-51. (in Chinese with an English abstract)

[6] 高秀梅, 孙平, 郭洪英, 等. 单幅相位图的二维位移分离技术与图像处理 [J]. 山东师范大学学报: 自然科学版, 2007, 22(1): 46-48.

GAO Xiu-mei, SUN Ping, GUO Hong-ying, et al. Isolation of two dimensional displacement for one phase map and image management [J]. Journal of Shandong Normal University (Natural Science), 2007, 22(1): 46-48. (in Chinese with an English abstract)

[7] 刘艳, 丁万山. 光学剪切电子散斑技术的改进与应用 [J]. 激光与光电子学进展, 2006, 43(6): 47-51.

LIU Yan, DING Wan-shan. Improvement and application of optical shearography [J]. Laser & Optoelectronics Progress, 2006, 43(6): 47-51. (in Chinese with an English abstract)

[8] 周文静, 于瀛洁. 基于光纤的三维电子散斑干涉测量系统设计 [J]. 光学精密工程, 2008, 16(10): 1815-1821.

ZHOU Wen-jing, YU Ying-jie. Design of 3D ESPI system by optical fiber [J]. Optics and Precision Engineering, 2008, 16(10): 1815-1821. (in Chinese with an English abstract)

本刊中的类似文章

1. 陈超; 于建国. 光成像技术用于地铁电阻式制动器热变形的测量[J]. 应用光学, 2008, 29(6): 849-853
2. 安晓强; 邱昆; 张崇富. 光码分多址系统中光学相关接收机判决阈值的分析[J]. 应用光学, 2006, 27(3): 177-182
3. 何建平; 周智; 王永政; 欧进萍. 基于光纤光栅绝对测量技术的高耐久智能钢拉杆[J]. 应用光学, 2009, 30(1): 118-124
4. 石一磊; 苏俊宏; 杨利红; 徐均琪. 基于相位偏移干涉术的薄膜厚度测量方法[J]. 应用光学, 2009, 30(1): 76-79
5. 黄水花; 周全; 谭吉春. 椭偏光谱测量中椭偏参数的灵敏度分析[J]. 应用光学, 2009, 30(1): 84-88
6. 付文清; 徐峰; 王永梁. 基于图像处理的高精度透镜包边方法研究[J]. 应用光学, 2009, 30(2): 229-232
7. 张德海; 梁晋; 郭成. 摄影测量中CCD相机精度对比方法研究[J]. 应用光学, 2009, 30(2): 279-284
8. 李浩; 张燕革. 模拟大气风场及其数据处理技术的研究[J]. 应用光学, 2009, 30(2): 285-290
9. 包学志; 高卫; 贾养育; 吕鸿鹏. 背景散射对LRCS测量精度的影响分析[J]. 应用光学, 2008, 29(4): 590-594
10. 程音; 于德敏; 许增朴; 王永强. 基于光栅投影的轮廓测量改进方法[J]. 应用光学, 2008, 29(4): 619-624
11. 鱼奋岐; 雷金利. 头盔瞄准具瞄准线参数解算方法的研究[J]. 应用光学, 2008, 29(supp): 145-147
12. 张帆; 陶坤宇. 空间环境高精度光电轴角测量研究[J]. 应用光学, 2008, 29(4): 614-618
13. 屈红; 马卫红. 基于旋滤波的颗粒衍射图样滤波方法[J]. 应用光学, 2008, 29(supp): 120-123
14. 杨鹏翎; 王群书; 冯国斌; 刘福华; 程建平. 一种光纤光栅动态应变传感器[J]. 应用光学, 2008, 29(supp): 105-108
15. 邹士迁; 周霖. 激光雷达在靶场测量中的应用分析[J]. 应用光学, 2008, 29(supp): 83-86