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信息科学

采用Gerber文档的印刷电路板表观检测

张静^{1*}, 叶玉堂¹, 谢煜¹, 刘霖¹, 常永鑫^{1,2}

1.电子科技大学 光电信息学院, 四川 成都 610054 2.中国科学院 光电技术研究所, 四川 成都 610209

摘要: 对印刷电路板(PCB)进行表观检测时,传统标准板的图像建立是利用PCB图像自身的特征进行配准和分层的,故检测精度不高。本文从PCB表观检测的实际需求出发,提出了新的检测系统。该检测系统引入解析Gerber文档对PCB光电图像进行分层处理,利用形态学的方法自动修正解析后的Gerber文档,建立精确的标准板。根据主分量分析提取彩色图像频带丰富的信息,依据检测缺陷的尺寸大小设置各层模板及检测阈值,实现局部针对性检测,提高检测精度。实验结果表明,与传统的基于颜色分区域方法相比,基于Gerber的方法不仅提高了检测精度,且较大幅度地提高了自动光学检测系统的检测效率,其微小缺陷检测率高达95.1%,25 cm×22 cm电路板检测时间仅需1.09 s,满足了在线检测对速度的要求。

关键词: 印刷电路板(PCB) 自动外观检测 缺陷检测 Gerber文档 灰度形态学

Appearance detection for printed circuit board by Gerber file

ZHANG Jing¹, YE Yu-tang¹, XIE Yu¹, LIU Lin¹, CHANG Yong-xin^{1, 2}

1. School of Opto-electronic Information, University of Electronic Science and Technology of China, Chengdu 610054, China;

2. Institute of Optics and Electronics, Chinese Academy of Sciences, Chengdu 610209, China

Abstract: When the surface defect of a printed-circuit-board (PCB) is detected by a traditional method, it usually has lower detection accuracy for that the traditional method of standard board is built by properties of PCB image itself. According to the accurate requirements of PCB detection, this paper proposes a new detection system. In this system, the layers of PCB photoelectric image were separated by using Gerber file that have been analyzed, then the analyzed Gerber file was corrected by morphology. And a accurate standard board was built. Furthermore, the frequency information in the color image was extracted based on the principal component analysis, and the detection threshold was set according to different information on different layers. By which, the local detection of PCB was completed and detection accuracy was improved. As compared with the traditional method by color stratification, this method improves detection accuracy and detection efficiency of the system. It achieves the detecting probability of 95.1% for micro defects and the detecting time of 1.09 s for a 25 cm×22 cm PCB. The detection efficiency of automated optical inspection system can satisfy the requirement of the PCB for defect inspection in online and real time.

Keywords: printed-circuit-board (PCB) automatic visual inspection Defect detection Gerber file grayscale morphology

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通讯作者: 张静

作者简介: 张静(1984-), 女, 河南洛阳人, 博士研究生, 主要从事基于视觉的高端光学设备及仪器研发、图像处理算法的研究。

作者Email: zhangjing619@gmail.com

参考文献:

- [1] MAR N S S, YARLAGADDA P K D V, FOOKES C. Design and development of automatic visual inspection system for PCB manufacturing [J]. Robotics and Computer Integrated Manufacturing, 2011, 27(5): 949-962.
- [2] TEOH E K, MITAL D P, LEE B W, et al.. Automated visual inspection of surface mount PCBs [J]. Signal Processing and System Control Factory Automation, 1990, 576-580.
- [3] WANG D Z, WU C H, ANDREW I, et al.. Fast Multi-template matching using a particle Swarm optimization algorithm for PCB inspection [C]. Conference European Workshops on the Theory and Applications of Evolutionary Computation, 2008, 4974: 365-370.
- [4] SOMATILAKE S, CHALMERS A N. An image based food classification system [C]. Proceedings of Image and Vision Computing, New Zealand, 2007: 260-265.
- [5] TEOH E K T, TSENG C C, CHENG M S, et al.. Electric contacts inspection using machine vision [J]. Image and Vision Computing, 2010, 28(6): 890-901.
- [6] CHIU S N, PERN M H. Reflection-area-based feature descriptor for solder joint inspection [J]. Machine Vision and Applications, 2007, 8: 95-106.
- [7] 刘建伟, 梁晋, 梁新合, 等. 大尺寸工业视觉测量系统 [J]. 光学精密工程, 2010, 18(1): 126-134.
- [8] LIU J W, LIANG J, LIANG X H, et al.. Industrial vision measuring system for large dimension work-pieces [J]. Opt. Precision Eng., 2010, 18(1): 126-134. (in Chinese)
- [9] WEI ZH, ZHANG G J, LI X. The application of machine vision in inspecting position-control accuracy of motor control systems [C]. Proceedings of the Fifth International Conference on Electrical Machines and Systems, Shenyang, P.R. China: ICEMS, 2001: 1031-1038.
- [10] 姚蛟, 叶玉堂, 张静, 等. PCB自动光学检测中Gerber文件的解析研究 [J]. 计算机工程与设计, 2012, 33(6): 2481-2485.
- [11] YAO J, YE Y T, ZHANG J, et al.. Research of parsing Gerber file in PCB automatic optical inspection [J]. Computer Engineering and Design, 2012, 33(6): 2481-2485. (in Chinese)
- [12] 吴福培, 邝泳聪, 张宪民, 等. 基于模式匹配及其参数自适应的PCB焊点检测 [J]. 光学精密工程, 2009, 17(10): 2586-2593.
- [13] WU F P, KUANG Y C, ZHANG X M, et al.. Pattern matching and based PCB solder parameter adaptive joint inspection [J]. Opt. Precision Eng., 2009, 17(10): 2586-2593. (in Chinese)
- [14] 王映辉. 人脸识别原理、方法与技术 [M]. 北京: 科学出版社, 2005.

出版社,2010,41-42, 124-130, 225-240, 142-150. WANG Y H.Recognition Theory,Methods and Techniques[M]. Beijing:Science press, 2010,41-42, 124-130, 225-240, 142-150. (in Chinese) [12]KISHIMOTO S, KAKIMORI N, YAMAMOTO Y, et al.. A Printed Circuit Board (PCB) inspection system employing the multi-lighting optical system [C]. 8th IEMT International Electronic Manufacturing Technology Conference, IEEE, 1990, 120-129. [13]黄杰贤,李迪,叶峰,等. 挠性印制电路板焊盘表面缺陷的检测[J]. 光学 精密工程,2010, 18(11):2443-2553. HUANG J X, LI D, YE F, et al.. Detection of surface defection of solder on flexible printed circuit [J].Opt. Precision Eng., 2010, 18(11):2443-2553.(in Chinese) [14]HAE-WON OH, TAE-HYUNG PARK. Gerber-character recognition system of auto-teaching program for PCB assembly machines [C]. SICE Annual Conference, 2004, 1: 300-305.

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1. 王晟 张振荣 邵珺 李国华 胡志云 叶景峰.瞬态流场定量测量中平面激光诱导荧光图像的降噪[J]. 光学精密工程, 2013,21(7): 1858-1864
2. ZHAO Li-ping, LI Xiang, FANG Zhong-ping.塑料眼镜内外缺陷检测的全内反射照明技术[J]. 光学精密工程, 2011,19(9): 2247-2254
3. 王庆香, , 李迪, 张舞杰, 叶峰.

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[J]. 光学精密工程, 2010,18(4): 981-987

4. 朱越,刘文耀,刘方超,王晋疆.基于二次曝光数字全息技术的轮胎内部气泡缺陷检测方法研究[J]. 光学精密工程, 2009,17(5): 1099-1104
5. 赵红颖, 于微波.计算机视觉技术在发动机缺陷检测系统中的应用[J]. 光学精密工程, 2000,8(3): 283-286

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