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Defect detection algorithm for semiconductor ice package by image analysis method

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Abstract
This paper aims at developing a defect detection algorithm for semiconductor IC package by image analysis of a single captured image, without reference to another image during inspection. The integrated(IC) pattern is usually periodic and regular. We propose a method where the defect detection algorithm first segments the captured image into different regions by asset of morphological segmentations with different structuring element sizes. Then a region properties, is calculated for each segmented region. Lastly, the defective region is extracted by the region properties of the image. The experimental results are promising. Future work will focus on variant orientation of a IC package.

Keywords: defect detection, image analysis, region properties.

1. Introduction
With the advancement of electronic technology, ICs become the fundamental component of all electronic devices; there is notable growth in the IC production in recent years. Throughout the semiconductor assembly and packaging processes causes malfunction in the IC,s at the end. Those ICs with defects cause loss in the production yield. In order to enhance the production yield, defect detection of the IC is tedious during the manufacturing process. It is often difficult for human inspector to detect the tiny defect on the small integrated circuit with complex circuit pattern. The human detection is a labor intensive step and could become the critical bottleneck in the production process. Therefore, human detection is not competitive enough when compared with the automated machine vision system, which is often more effective, efficient and easier for quality control.

2. System Specification
A. Nature of Application
Size of the smallest feature to be detected: Not applicable. Required accuracy: 100%.
100% inspection: Suitable for 100% inspection. Offline/In-line inspection: In-line inspection.
Retrofit/New Design: New Design.
Nature of Decision Making: based on region properties.

B. Scene Constraints
Discrete parts/Endless material: IC 7805, TO- PACKAGE. Dimensions (min, max): 1cm*2.9cm.
Color and Surface Finish: No shiny and jaggy surfaces. Changes due to handling: Not applicable.
Number of part types: 1 (IC 7805).
Difference of parts: Not applicable Batch
Production: Applicable.
Can production change be addressed? Yes.
Indexed/Continuous/Manual Positioning: Manual Tolerances in positioning (x, y, z translations and rotations): tolerance in positioning.
Max. Number of parts in view: 1

Overlapping and touching parts: No.
Environmental factors: Noise and External lighting. Performance Requirements
a. Time: 3secs
b. Accuracy: 100%**.**
c. Hardware Specifications: Intel core2 Duo

Camera Scan Type: Area scan Camera (Color/Mono): Mono Camera Make and Model: AVT Stingray F201C Field of View: 71 cm
a. Maximum part size: 1*2.9cm.
b. Tolerance in positioning: 14*19.5cm.
c. Margin: 3cm.
d. Adaption to the aspect ratio of the camera sensor: 1.33.

Camera Sensor Resolution: 2 Megapixel. Sensor Size and Aspect Ratio: 1/1.8" and 4:3.
CCD/CMOS: CCD.
Object Resolution: Not applicable.
Camera Interface: IEEE1394b, F2M5-MONO8-1600*1200.
Progressive/Interlaced Scan: Progressive Scan. Frame Rate: 14.7
Shutter Seed: 40000 microseconds. Working Distance: 39cm.
Lens Focal Length: 25mm. Primary Magnification: 0.006 Lens Mount type: C-Mount.
Aperture Size and f#: 1.17mm and 21.4. Fine Focus Setting: 0.5.
Image Contrast in %: 50%. Image Distortion: Yes.
Perspective Errors: Not applicable. Scene IL luminance: 140 lux.
Type of Light Source: LED.
Type of Lighting Technique: Front (Ring) lighting.
C. Software Specifications Software Library: Image Processing Toolbox. Hardware Platform: Intel Core2Duo. Software Platform: MATLAB R2010a. Image Acquisition Time: 0.64Seconds. Image Processing Time: 3 Seconds.

3. Methodology

A. Image Processing

The Defect detection algorithm first segments the IC image into different regions according to the circuit pattern. To optimize the segmentation for different defect sizes and shapes, a set of morphological segmentations with different structuring element sizes are used. By carefully linking and comparing the adjacent levels of the morphological segmentation, we can identify a proper segmentation with minimal number of segments. Then, a feature vector is calculated for each segmented region. The region property consists of many image attributes, such as area, centroid and bounding box. Some of these attributes are very outstanding for different classes of defects. Regularity measurement of each region is classified based on the feature vector. Lastly, the irregular region is extracted and classified as a defect. Fig. 1 shows the block diagram of the proposed algorithm.

B. Image Analysis

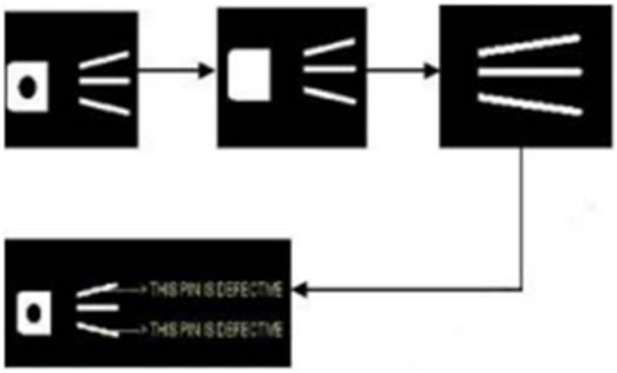
The image analysis involves the determination of the bounding box of the region of interest in the images. Based on the values of the length & width of bounding box, the defect of the objects can be easily determined.

Steps Involved

1. Acquiring Image of the specimen in monochrome mode
2. converting that into binary image
3. Filling the holes in the image of the specimen
4. Eliminating all regions other than region of interest[Pins]
5. Getting the values of bounding box for each pin
6. Comparing the width of the bounding box of each pin
7. Pin with greater width will be detected as bent pin
8. Comparing the length of bounding box for each pin
9. Pin with lesser length will be detected as broken pin
10. Otherwise, Specimen will be detected as No defects

Constraints

1. Back ground must be black
2. No orientation of Specimen is allowed



4. Results and Discussion

A defect detection algorithm for the semiconductor assembly process by image analysis of a single captured image, without reference to another image during inspection, is proposed. It can distinguish between the defective IC and non-defective IC effectively. The detection result depends on both of the sensitivity of the segmentation algorithm and the setting of the threshold in the classification. The location of the defect can be found out successfully.

5. References

1. 1.www.sciencedirect.com/science/article/pii/0734189X88901089
2. www.worldscientific.com
3. ieeexplore.ieee.org
4. www.science.gov
5. Analysis and Design of Analog Integrated Circuits, 5th Edition by Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer
6. Design of Analog CMOS Integrated Circuits 1st Edition by Behzad Razavi