

Homogeneous Pin-Through-Hole Component Inspection Using Fringe Tracking

Abstract

Automated visual inspection (AVI) systems are playing important roles in ensuring manufacturing quality in the electronic industry especially in the assemblage of printed circuit boards (PCB). Most existing AVIs that are used for PCB inspection are categorized as non-contact inspection systems consisting of a single overhead camera. Such systems, which can be manual or automated, are incapable of detecting 3D pin-through-hole (PTH) component placement defects and reporting them. By considering an assembled PCB as a textured surface with a predefined depth map, we propose to apply an angled fringe projection to detect defects in PTH component placement. It has been found that angled fringe projection can be used for surface analysis by applying phase shifting and phase unwrapping obtained from several images. However, the turnover time for PCB inspection is very crucial in the electronic industry. In other words, an alternative improved method that speeds up the inspection process is always desirable. This paper describes a method of applying an angled fringe projection for 3D height measurement using a single captured image and a direct triangulation technique. The main focus of this paper has been made on the development of a fringe tracking algorithm and its practical implementation details. This algorithm allows us to obtain the depth map of the surface under analysis with just one image. The simulated data and calibration process of the tracking algorithm are discussed and an experimental result is given for Peripheral Component Interconnect (PCI) component insertion in computer motherboards. With proper system calibration and accurate image processing, we demonstrate the successful manipulation of a structured collimated light source for height measurement using a single captured image.

Subject Keywords

Automated visual inspection

Fringe projection

PCB inspection