

AUTOMATIC OPTICAL INSPECTION OF MICRO DRILL BIT IN PRINTED CIRCUIT BOARD MANUFACTURING USING SUPPORT VECTOR MACHINES

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ABSTRACT. *Automatic optical inspection (AOI) of micro drill bits becomes more and more important with the rapid expanding of Printed Circuit Board (PCB) manufacturing industry. Traditional methods are mainly focus on geometric defects inspection of micro drill bits. This paper proposes a phase identification method using support vector machines (SVMs) for micro drill bits inspection. Three kinds of drill bit features are extracted as the input of SVMs. The Gaussian radial basis function (RBF), is adopted as kernel function, and one-against-one strategy is employed to extend dual category SVMs for multi-classification of micro drill bits. Classification performance is compared with artificial neural network, decision tree and k-nearest neighbor classifiers. The results indicate that the approach works well for AOI of micro drill bits.*

Keywords: Automatic optical inspection, Micro drill bit, Phase identification, Support vector machines

1. Introduction. Inspection of manufacturing tools is a big issue in industrial manufacturing for an attempt to achieve 100% quality assurance. With the rapid expanding of Printed Circuit Board (PCB) manufacturing industry, inspecting the drill bit efficiently and accurately has become an important task for PCB quality control in process of PCB manufacturing, because the manufacturing tools have strong impact on the product quality.

Since the increasing circuit density brings about continuing micromation of drill bits, the inspection has come into an enormous challenge. In the face of micro drill bits with a diameter of just one-tenth or even one-hundredth millimeter, it is obviously impossible to achieve the requirement by human visual inspection. One solution is that the quality controller works with the help of micrometers and microscopes. Such kind of manual inspection is time-consuming, subjective and costly [4]. As a result by no means can this measure achieve the requirement. The new dawn of this problem broke as the automatic optical inspection (AOI) method using computer version technology was put forward. AOI relieves inspectors out of the tedious jobs. Compared to manual inspection, it is time-saving, objective and non-contact [4,5]. However, most traditional AOI methods for micro drill bits in PCB manufacturing are based on template matching techniques [6]. They suffer from inflexibility, and noise sensitivity.

Alternatively, another kind of AOI methods is based on curve fitting [7,8]. At first the edge and corners of the drill bit are detected, then curve segments located on the edge