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RBF NETWORK AND EPC METHOD APPLIED TO AUTOMATED PROCESS REGULATIONS FOR PASSIVE COMPONENTS DICING

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Abstract. *Chip-type passive components (e.g. resistors, capacitors and inductors), owing to their excellent electronic properties, are widely used in the design of high-density PC boards. The excellences of the chip-type components are accomplished through rigorous controlling of every production step, especially the accuracy-demanding chip dicing operation. This research develops a machine vision system to find mass centers of chips, locate cutting lines and estimate process regulation plans for the automated, precise, and high-speed dicing of the chip-type components. The radial basis function (RBF) network and the engineering process control (EPC) method with response surface methodology are proposed to model the dicing deviations, and to timely and quantitatively regulate the process towards the target values. Experimental results show that the proposed process regulation approaches significantly outperform the current dicing method in adjustment performance.*

Keywords: Passive components dicing, Process regulation, Dicing deviation, RBF network, EPC method

1. Introduction.

Passive components (e.g. resistors, capacitors and inductors) contribute no power amplification in the circuit system and require only a signal to start their functions. As passive components require low or no power consumption, their importance and popularity have been increasing these years when energy conservation issues intensify. With the miniaturization of electronic products, chip-type components have been gaining their popularity and replacing traditional components. Chip-type passive components, owing to their excellent electronic characteristics, are widely applied in the high-density design of products such as PC boards, digital cameras, mobile phones, etc. The excellent electronic properties of high capacity, high stability and no positive or negative electrode are achieved through elaborate planning and rigorous controlling of every production step, especially the accuracy-demanding chip dicing operation which greatly impacts the electronic properties of chip-type ceramic capacitors.

Cutting alignment refers to positioning the capacitor substrate so the blade cuts at the intended position. Manual alignment requires the operator to align the capacitor substrate using a microscope. Automated alignment utilizes a vision system to recognize the target on the ceramic capacitor substrate and has the machine adjust the blade and the substrate position automatically to achieve the desired cut position. Automated alignment is capable of continuously adjusting the cutting positions to minimize process variations, while manual alignment has no such capability. The key of automated alignment lies in successfully recognizing the target, which is easy for targets with fine patterns but difficult for the ceramic capacitors with poorly defined edges.