A NOVEL METHOD FOR LOCATING SOLDER JOINTS
BASED ON MODIFIED BINARY POTENTIAL FUNCTION

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ABSTRACT. The solder joint location on inductors is an extremely important aspect of the industrial process; in particular, the visual location plays a fundamental role. The visual-location process is often carried out by human experts. The disadvantages associated with manual location are the large amount of time required and reduced efficiency as operator fatigue occurs. In addition, as electronic products now tend to be miniaturized, portable and with dense component layout, manual location is becoming unreliable. This has prompted the development of automatic visual-location systems to speed up the location process, increase production efficiency and improve manufacture yield rate. In this paper, we propose an automatic visual-location method for solder joints to address the problem of feature extraction in digital images, using the concept of potential functions (PF). In order to make the location method more suitable for the inductor industry, the virtual external electric field concept is introduced. The proposed location system, which uses modified binary potential functions (MBPF), has been implemented and tested with three kinds of inductors. The experimental results show that the proposed scheme performs with a high degree of accuracy, even with testing samples that are significantly different in appearance.

Keywords: Automatic visual location system, Feature extraction, Potential function, Modified binary potential function, Solder joint location

1. Introduction. Electronic devices are now ubiquitous in our daily life. Printed circuit boards (PCBs) play an important role in almost every modern electronic device. The inductor is one of the most important components in the PCB. There are various applications of the inductor. It stabilizes current and matches phases, but is also used for filtering waves, storing energy, releasing energy, resonance, bypass and more.

Inductors are used extensively in analog circuits and signal processing. The diverse appearance of inductors is shown in Figure 1. The requirements of inductors depend on how and where they are used. Inductors, in conjunction with capacitors and other components, form tuned circuits, which can emphasize or filter out specific signal frequencies. For example, large inductors were previously used as chokes in power supplies, which in conjunction with filter capacitors removed residual hum or other fluctuations from the direct current output. Small inductances, generated by a ferrite bead or torus around a cable, are used to prevent radio frequency interference from being transmitted down the wire. Smaller inductor-capacitor combinations are also used to provide tuned circuits, used in radio reception and broadcasting.

The elimination of electromagnetic interference for electronic products is the basic requirement of electronic products. Since only those complying with the regulations can be sold, the demand for inductors is strong.

Since electronic products tend to be miniaturized, portable and with dense component layout, surface-mount components can be developed rapidly. The miniaturization of the