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# Using Vision System and Neural Network to Create the Relationship Between the Clearance and the Precision of Micro-punched Burr

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## Abstract

Punching is widely used in the shaping or processing of sheet metal and nonmetal works, as it is not only fast but also economic and highly accurate compared with other processing methods such as casting, forging and metal processing. Typically, it is applied to the fabrication of clock and watch parts, automobile parts, IC package material, and various kinds of sheet metal or thick metal parts. The IC package is turning to be more and more minimized from the early 0806, 0603 chips to 0402 ones. The size of the hole of packaging bag has to be precise and suitable for any type of IC chip. The accuracy of packaging bag depends on the clearance parameters of micro-punch and die. This study utilizes the vision system to measure and distinct the burr length after the micro-punched. Once the different punch/die clearance is given, the developed abductive network model can create the relationship between the clearance and the burr-length of the piece after the piece is punched, and it can accurately predict the burr length in any different clearance parameters. The optimal punch/die clearance parameters can then be reached through a Simulated Annealing (SA) optimization algorithm.

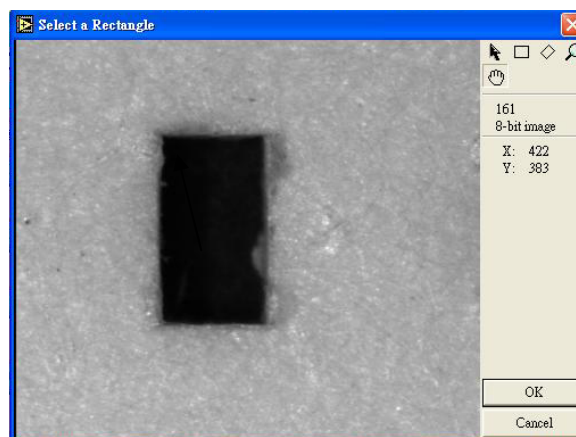
Key words: micro-die, vision system, simulated annealing (SA)

An image vision system is shown in Figure, it includes the CCD(Teli 3910 CCD CAMERA) 、 the image capturing card (National Instruments IMAQ PCI/PXI-1422) and the XY-Table. The image inspecting software is written by National Instruments LabVIEW 6.i and IMAQ Vision Builder 6, which can judge the size of burr automatically; Figure shows the interface of image vision system, Fig.5 shows the burr size of products.

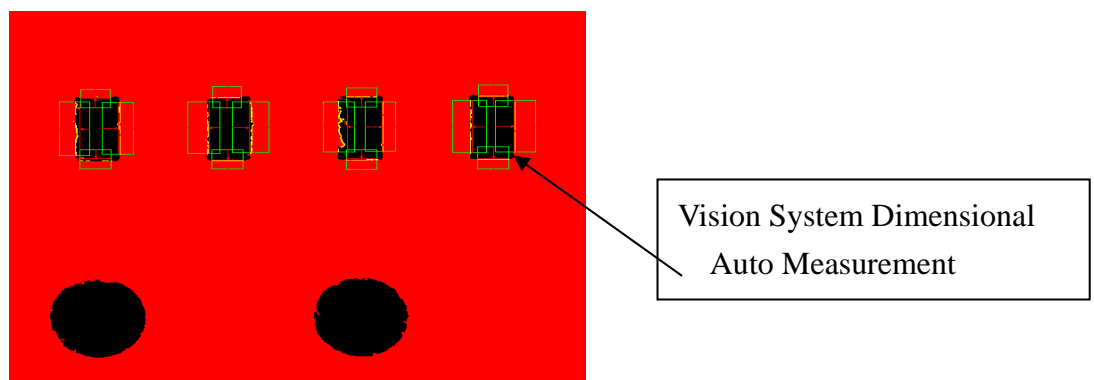
The contour searching is to find out the outline of parts by scan, shown as figure, each searching line search the image of contour to find the point on the edge, and connect each edge point to build the contour of the parts. From Fig.7, each edge has a smooth change from bright to dark (or from dark to

bright), it is a gray level variation not a sharply change; this shows the edge of the digital image has a slightly blurred, the point position that obtained by search depends on the gray level parameters setting (contrast, width of filtered wave, steep and relative width of search line)

The CCD take a photo and position the feature of image. In order to showed the burr and took the noise signal away, the image was treated by two polar treatment. The Remove Small Objects function in the program was applied to eliminate the individually small noise signal to reduce the erroneous judgement. In order to eliminate the disturbance near the aperture, it uses the Invert Binary Image function to reveal the disturbance near the aperture, then uses the Remove Borders Objects function to eliminate the disturbance near the image, finally uses Invert Binary Image function again to restore the original image for measurement.



Measurement inter



Vision System Dimensional Measurement