Z 축 움직임을 이용한 버측정 능력의 확대

nhancement of urr measurement capa ilit using a is adaptation

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1. Introduction

Burr is an undesirable projection as result of plastic deformation. Burr minimization and effective deburring process are required strongly to reduce the cost of the machined parts. In doing these efforts, the precise burr measurement must be provided for the efficient process.

The burr measurement system uses conoscopic holography sensor which offers certain advantages over interferometry, triangulation and dynamic focusing, for point-by-point distance mapping. However, the previous system has dealt with some difficulties to measure the burr on curved surfaces which causes the out of range signals. This paper introduces the improvement to enhance the capability of burr measurement system using Z axis.

2. urr measurement s stem

The measurement system is composed of Conoprobe sensor, stepping motors driven XY table with high precision leadscrews (resolution 1.5 µm/step), and added stepping motor driven Z axis (Fig. 1). Table controller and Z axis controller are connected via I^2C bus (VXM bus cable). Then all the stepping motor controllers and sensor controller are connected to a host PC via RS-232 and LPT ports (Fig. 2).

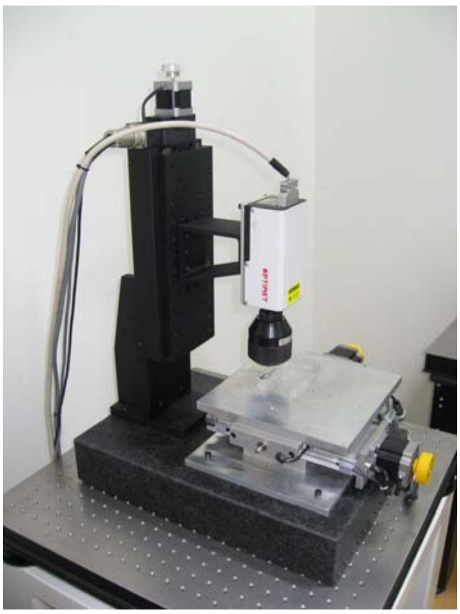

Fig. 1 Photo of the system

Master controller and slave controller drive the XY stepping motors and Z stepping motor respectively. These two controllers use VMX bus cable so host PC just need only one RS-232 port to control XYZ axes. L1, L2, L3 are the limit switches for each axis (Fig. 3).

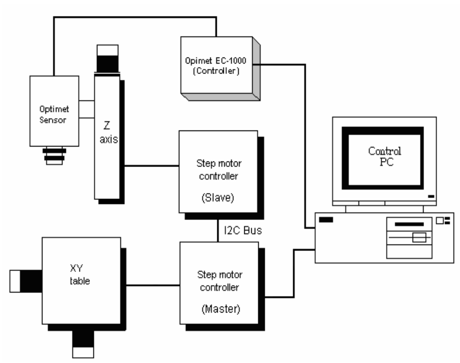

Fig. 2 Layout of the system

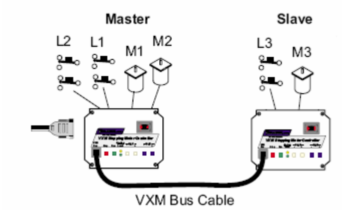

Fig. 3 Stepping motor controllers connection

In previous measurement system, the measuring range and precision of the probe can be adjusted by only changing the objective lens. Two lenses with the focal length of 16mm and 25mm, namely lens 16 and lens 25, are used according to the size of burr (Table 1).

ensor		pot size	or ing range	solute accurac
tandard	25mm	22µm	1.8mm	<3µm
	16mm	11µm	0.6mm	<2µm
igh Definition	25mm	6µm	0.65mm	<1µm
	16mm	3.5µm	0.20mm	<0.5µm

Table 1 Specification of Optimet Conoprobe sensor

To automatically adjust the distance in Z axis and adapt for the different geometry boundaries of the measuring surface, curve following functions are developed in burr measurement software. This function applied the fuzzy algorithm to adjust the vertical distance between the sensor and measuring surface. By this method, the sensor can follow different kinds of curved and slop surface which cause many difficulties and need to be considered the size of measured area in previous system.

The adaptation function uses for controlling the Z axis, keeps the sensor always working in range, and make it as an advantage to measure the burr and micro burr more widely.

For large size of curve or slope surface compared with the maximum working range that previous measurement system can only reach to the value 1.8mm by changing lens 25, and using Standard Conoprobe sensor, the new system is independent of the lens of sensor. Changing lens does not affect the measuring range except altering the accuracy for each case of burrs measurement.

3. periments

The burr measurement of drilled holes on a flat surface and curved surface (Fig. 4) which not use the Z axis adaptation, need to be considered the working range of the sensor. In this measurement, the limitation of measuring range depends on the sensors. When using Conoprobe Standard sensor and lens 16, the effective measuring range is less than 0.6 mm. So the burr on curve surface which depth is over 0.6 mm can not be measured.

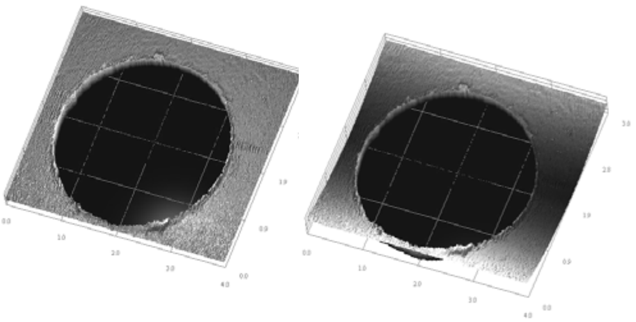

Fig. 4 Burrs on plane and curved surface

To test the ability of Z axis adaptation system, the Standard sensor with lens 16 is used to measure ∅3 crossing drilled hole through ∅ 10 cylinder surface (Fig. 5). The depth of the curve in 5 x 5 mm scanning area is 0.67 mm which is larger than the working range of the Conoprobe sensor. By using Z axis adaptation function, the sensor can track the boundary of the curved surface while scanning the verified XY input scan area.

Fig. 5 Crossing holes

Fig. 6 shows the result measurement image of the burrs around the crossing hole. The good signals ratio, which calculated from sensor recorded data, displays in burr measurement control software shows that the sensor always works in range during the time of scanning curved surface.

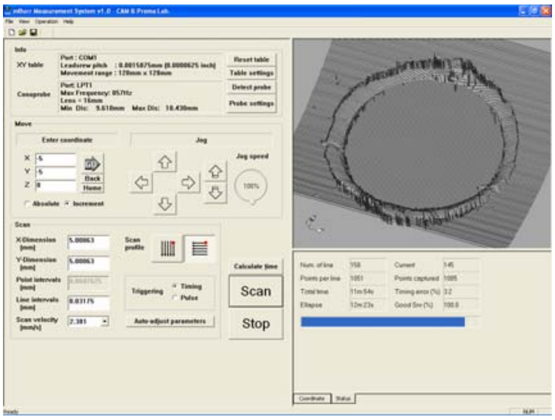

Fig. 6 Measurement result of crossing hole

Fig. 7 shows the result of ∅10 steel rod curved surface measuring with Standard sensor and lens 16. With 4 x 8mm scanning area, the height of this curve is over 1.8 mm. But the new system can successfully follow this boundary, and record scanning data which is used to analyze the roughness, and the defects of this tool by using burr analysis software.

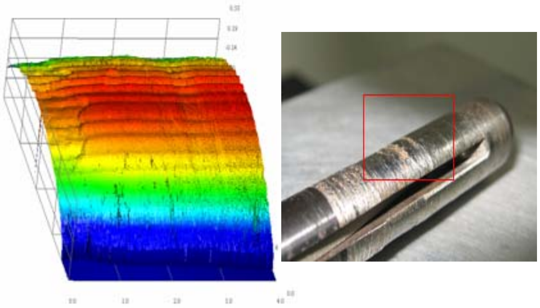

Fig. 7 Measurement of curved surface

4. onclusion

The burr measurement system based on Conoscopic holography sensor with Z axis adaptation can measure micro burr and burr geometry on slop or curved surface. It is useful for measuring and analyzing the burr on unflat surface, or expanding the measurement that the range of lens can not reach.

After this work, improving the functions to measure burr more precisely in crossing holes and complicated surface will be continued.

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