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TECH TALK

BY JOHN D. MANLEY

Some probing thoughts on grinding

Gone are the days when an operator had to measure and grind repeatedly. Today's CNC grinding machines have sophisticated probes that replace this laborious and error-ridden function.

In days of old the operator would regularly use verniers, calipers, micrometers and height gauges. As time progressed, the digital micrometer became more popular. Eventually, machine tool builders realized the value of interfacing these devices to the CNC controller. Unfortunately, early attempts at incorporating in-process probing were unreliable and often required an independent stroking axis to approach the workpiece. Today's more advanced grinders generally use the natural axes of the machine tool to position themselves to the workpiece, very reliably.

Software was the next stage in the revolution of probing. The marriage of excellent mechanics to the machine control was critical. Early controls had crude software that relied on ISO codes to probe, with limited functionality. Today's grinders now offer icon driven subroutines. The data garnered from these probes is used for both grinding set-up and quality studies.

Here are three common CNC grinding methods that show the advances machine tool manufacturers have made in probing.

First, **tool and cutter grinding** saw the introduction of automatic length and radial positioning of tools within their holders. Flute spacing and spiral lead checks have become standard. Even difficult Krest-cut endmills are now measured at their sinusoidal cutting edge, greatly simplifying automatic primary angle generation. Complex porting tools, as well as subland drills, have incorporated multi-step rake distortion probing subroutines. This combination of capabilities has made it possible to produce tools more consistently with accurate land widths and predictable helixes.

Second, **cylindrical and out-of-round grinding** has incorporated length-position probing to make up for centre variances, as well as finding print datum. Radial positioning probes allow for thread and out-of-round starts to be determined. With air-gap elimination sensors, the grinder can also minimize airtime on grinding in-feeds — providing tremendous cost savings.

Last, probing systems in **surface and creep feed grinding** can sense part alignments in all linear and rotary axes. With this sensed data we can now rely on the machine, rather than the operator to establish part alignment — saving a tremendous amount of setup time. In specific cases, such as CNC broach fabricating, probing has been invaluable in finding the longitudinal start points for bumper teeth, as well as sensing the pitch and rise per tooth of the cutting teeth, thus minimizing stock removal and maximizing tool life.

Where will the evolution of probing and gauging lead us? One manufacturer recently introduced **optics** into the grinding process. This allows rapid, accurate measurements of part dimensions with non-contact gauging. Exporting DXF compatible CAD profiles for use in CAM is also possible, as is reverse engineering of complex, contoured profiles. This development is taking manufacturing to the next step — closed loop grinding.

Cost savings could be enormous if probing and gauging are well implemented.

Cost savings could be enormous if probing and gauging are well implemented. Perhaps your engineering staff should evaluate your use of height gauges, micrometers, calipers and calculators because much of this equipment is quickly being replaced by CNC-controlled probing. CMM

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