QUALITY SCAN

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Inspect Parts on the Machine

On-machine inspection really isn't anything new. Old-time machinists used micrometers, calipers, and manual gages to inspect their work on the machine. Virtually all modern grinders have in-process gages to monitor part size. Today, on-machine measurement has evolved into the machine-tool environment using electronic touch probes and software derived from CMMs. These developments allow a machine tool to inspect the part on the machine much as a CMM would inspect the part off-line.

Moving inspection out of the lab and onto the shop floor offers a number of advantages: Inspecting parts on the machine where they are made essentially eliminates thermal variations, the influence of changes in clamping forces, tool wear, coolant changes, and everything that happens to a part as it's moved between the machine and a CMM located in the quality lab. It also saves all of the time involved in handling the part and getting the inspection results back to the machine tool.

Advanced inspection capabilities, software, and fast computers are **moving multidimensional shape inspection onto the shop floor.**

When critical features of the part are inspected on the machine, the part can be reprocessed immediately, if necessary, without changing the fixture and clamping forces involved, and under practically identical machine and tool conditions. These systems aren't just for size control, either. Advanced inspection capabilities, sophisticated software, and fast, powerful computers are now moving multidimensional shape inspection out of the lab and onto the shop floor.

Nearly all parts today are created as mathematical models in a computer. The model is then used to generate a program for a machine tool control. The model is 3-D and contains not only dimensional data, but the geometric relationships between the various dimensions as well. Also, the same CAD model used to design and machine the part can be used to facilitate its measurement on the machine tool using a program like our company's 3-D Shape Inspector (3DSI).

Furthermore, the DMIS code generated by many CMM machines can be directly input into 3DSI software to touch the same points touched on the part by the CMM, but using the machine tool and a probing system. Touching similar points will allow operators and engineers to see a direct correlation between the CMM and the on-machine measuring system.

Current on-machine probing and gaging technology can, in many cases, approximate the accuracy of a CMM or other computerized laboratory-measurement tool, and do it right on the machine tool. If the machine is well maintained, properly calibrated, and kept in a climate-controlled environment, measurement data from a CMM can correlate very closely with measurement data obtained on a machine tool.

A comparison of conventional and multidimensional shape inspection-based process control using a tool like our software demonstrates the time-saving advantages offered by the new technology.

The traditional process flow is:

- Design the part with 3-D CAD.
- Create the part program and transfer it to the machine.
- Start the working cycle.
- Remove the part from the machine.
- Check the semifinished part on a CMM.
- Reload the part on the machine.
- Finish-machine the part.
- Remove the part from the machine.
- Check the finished part on a CMM.

The process flow using multidimensional shape inspection technology becomes:

- Design the part with 3-D CAD.
- Create the part program and transfer it to the machine.
- Start the working cycle.
- Check the semifinished part on the machine.
- Finish-machine the part.
- Check the finished part on the machine.

In most cases, of course, the use of a lab-based CMM is still desirable for conducting comprehensive measurement programs, and for auditing the process. But the combination of proven on-machine inspection capabilities with multidimensional shape inspection moves manufacturing one step closer to the goal of making a good part the first time and every time. And while it isn't time to shut down the quality lab yet, quality professionals in manufacturing had better start getting used to having chips in their shoes.