

The State of Measurement Technology

Gear Solutions talked with Michael Stepke, Zoller's product specialist for inspection machines, about how the tool manufacturing industry's demands for higher quality require process control and complete documentation of production processes and how today's inspection machines address these needs.

What are the trends you have seen in measurement technology in recent years?

Due to an increasing national demand and growing shortage of specialists in the U.S. market, automation, process control, and documentation are increasingly required by the tool manufacturing industry. A worldwide growing importance in regard to process stability and precision in production goes hand-in-hand with current demands and requirements in precise tool measurement and inspection. Complete documentation has become particularly essential.

Modern precision cutting tools such as drills with complex front features and ever-narrowing tolerances meet this requirement. Therefore, some companies have long seen those topics as a necessary evil and additional unnecessary cost, but this has now changed. In the last two or three years, tool grinders and manufacturers have developed a growing acceptance or have experienced more pressure to invest in new measurement equipment with modern technology.

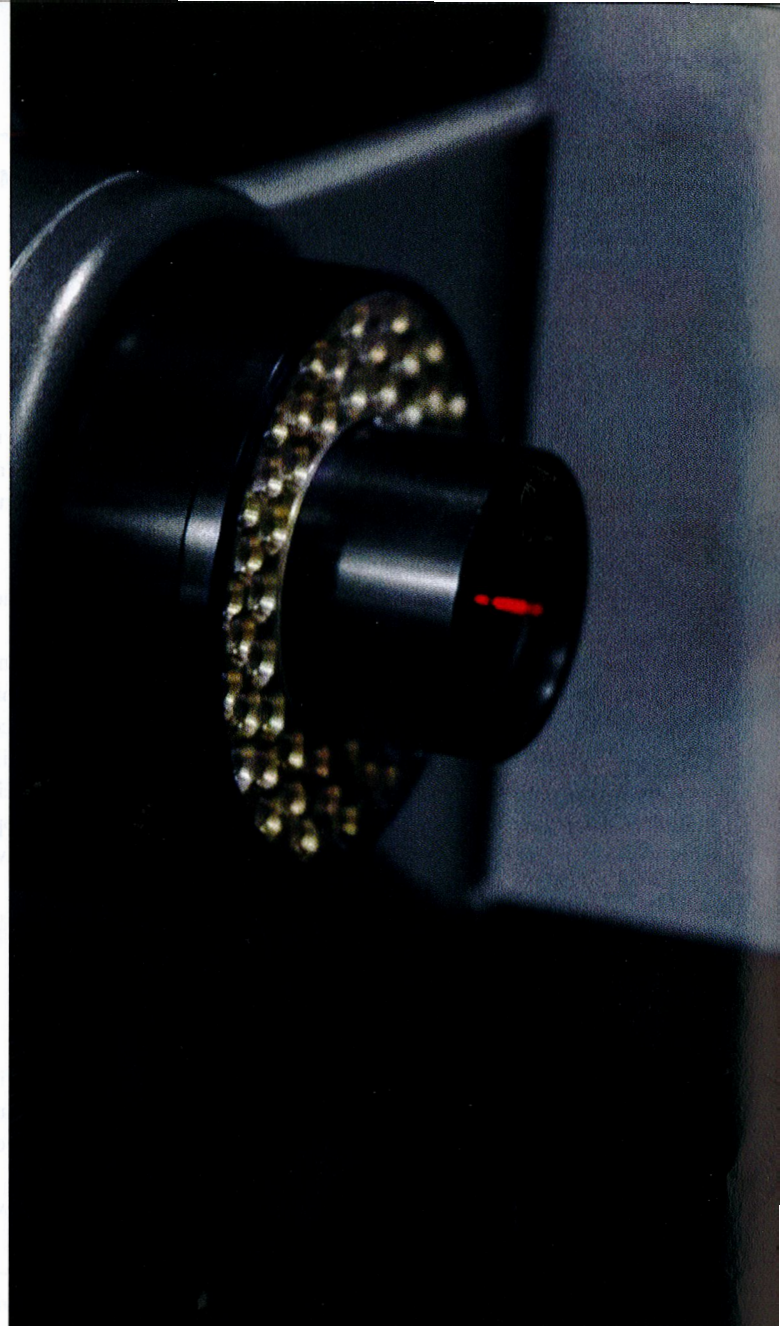
And there is a need for both fully automated tool inspection of the complete tool and for a quick in-process measurement of some parameters, elements, and contours only.

How does Zoller react to these new challenges?

We have developed the "Pom" series for process-oriented measurement. It is important to quickly and precisely measure and inspect a tool in-process and directly next to the grinding machine. Documentation becomes more important even at that step. This saves time by avoiding long distances to the inspection room. The grinding machine can run again in the shortest time possible.

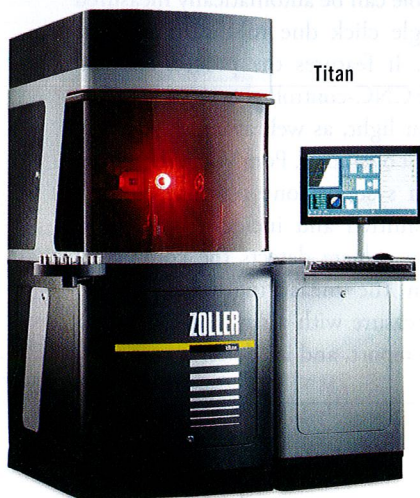
The current tool has to be compared quickly to the dimensions required for the setup and then as correction values entered into the controls of the grinding machine. The in-process inspection of cutting tools using toolmaker microscopes in particular is nothing new. But latest developments introduce new technology to the in-process inspection machines.

Automatic cutting edge recognition, based on many years of experience with high-end CNC inspection machines, speeds up the measurement process and introduces an unknown accuracy to the Pom series. A dynamic backlight is capable of recording the maximum contour free from influences from helical angles, showing one recorded image over all cutters. Guesswork and time-consuming "eyeballing" of radii on ball nose end mills is history. DXF profile comparison can be accomplished



right at the CNC grinder under a high level of documentation. That being said, the thermal growth of the grinding machine can also be documented and corrected from tool to tool. This is particularly valuable for longer tool runs.

The "Titan" meets all needs and requirements for a fully automated, complete measurement of cutting tools with the highest level of precision with up to seven CNC controlled axes. Due to its integrated,



Titan

fully automated sensor, the verification of the cutting edge preparation can be accomplished independent from the operator with a high level of accuracy. Cutting edge geometries like radii and special forms can be detected and measured with high repeatability. If these measurement capabilities are combined with the new generation of “RoboSet 2,” a robotic cell including a robot with eight tool storage pallets,

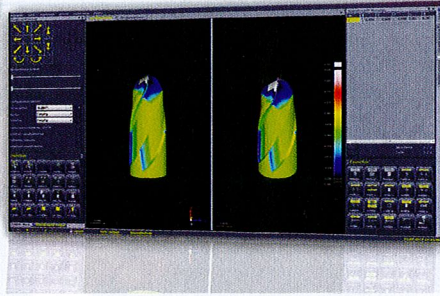
laser marking, and ultra-sonic washing station, then 24/7 tool inspection truly becomes a reality.

Threading tools are increasingly being used in the automotive sector in particular. Are there any innovations with regard to measurement technology?

Yes, automatic operator-independent measurements of taps is becoming ever more important. Zoller’s “ThreadCheck” with six controlled axes offers a precise measurement. A rotatable optical carrier that’s set to the helical angle will eliminate the long-standing challenge of measurements free from optical distortion that optical systems had. Helical edges and tooth flanks can be exactly measured due to the pivotable optical carrier for the sixth axis. This is unique on the market.



3dCheck



Hob cutters require similar characteristics for the measurement machine. An optical carrier enabled to measure distortion-free is also required, as well as a touch probe to be compliant with several standards such as DIN 3968. All those measurements are made possible using “HobCheck.” The hobs can be measured precisely and easily using an expanding mandrel or between centers.

What is process-oriented measurement, and what benefits does it have compared to traditional measurement methods?

POM stands for process-oriented measuring, and that means quick and precise measurement, inspection, and documentation supporting each production step. Zoller’s Pom series of machines allows us to address specific and specialized measurement tasks. This covers machines dedicated to measure, for instance, the cutting edge preparation, diameters, and basic geometries solely. Being able to address specific measurement needs by a machine specifically made for that need will allow simplification of the measurement process. Process-oriented measuring is of particular interest in the U.S., where there are about 75 devices installed so far.



HobCheck

Does Zoller offer measurement technology suitable for the shop floor? How does it work in the production environment?

The Zoller Pom series of machines are all built for a direct use on the shop floor next to the machine, but of course, can also be used in an inspection room. That is also valid for our fully automated measurement machines: the “Genius,” the ThreadCheck, and the HobCheck. This is what many of our customers have been doing for years. However, the environmental conditions — such as floor vibrations, light, and especially temperature — need to be considered to guarantee the required accuracy level. Calibration gauges and routines simplified for the end user help to achieve these goals.

What about data transfer to the machine?

With the new universal GDX (Grinding Data eXchange) interface, Zoller is part of a new initiative to develop a data transfer protocol, or standard, for the whole tool grinding industry. This format will become more accepted in the future, simply because there is a demand for a unique interface on the market.

Various customers are already successfully using data transfer from the measuring machine to the CNC grinder provided by Zoller to the specific machine control. The virtual measurement machine, “Caz” (computer-aided Zoller), allows the programmer to create complete measurement sequences offline using the 3D model without the need to wait for the tool to be made. The single source data entry will guarantee that no information will be lost in GD&T data exchange between the programming and manufacturing phase. The measurement sequence is saved seamlessly at the design stage to the single database in use. In the meantime, Genius is available for measurement and not occupied by programming work. Measurements can always be performed immediately.



ThreadCheck

What can we expect in the near future for measurement technology?

Today, when high-percent quality control, traceability, and process control are essential factors of success for manufacturers, 3D measurement technology is a trendsetting procedure. Many geometries and forms can only be measured completely and exactly using 3D digitalization. Zoller’s “3dCheck” combines the benefits of a 3D sensor, high-precision CNC axes, and fully automated image processing. We are continuously developing this system.

The Pom series for process-oriented measuring was introduced in 2011 and has built a worldwide reputation for being the fastest measurement machines of its kind. And the Pom series now includes the “PomMicroScope” designed for measuring and inspecting flat components as well as molding and turning plates while being suitable for shop floor use. All parts on the machine table can be automatically measured with a single click due to the one-button application. It features the process-oriented usage, three CNC-controlled axes, transmitted and incident light, as well as smart software for the easiest operation. PomMicroScope uses two camera systems: one processes images using transmitted and incident light while a navigation camera detects the component position on the measuring table. Simply position, measure with a single mouse click, and output report, and it’s done. 📄