

New Compact Machines Accelerate the Spread of Computed Tomography

A Further Development of Tube Technology

The latest generation of coordinate measuring machines for computed tomography (CT) applications costs less, is smaller and easier to use. That is why these machines are increasingly replacing conventional 3D measuring machines. Werth Messtechnik has introduced two compact machines with new software capable of measuring injection molded or extruded plastic parts both atline and inline in real-time.



The TomoScope XS Plus compact machine with microfocus transmission tube offers Raster Tomography of several workpiece groups on various levels of the fixture. © Werth Messtechnik

The main advantage of computed X-ray tomography over conventional sensors is complete measurement at the touch of a button. With Werth measuring technology the workpiece is placed on a rotary axis between the x-ray tube and the detector. Suitable measurement parameters can be detected automatically, and a mouse click starts measurement. A workpiece volume is reconstructed in

digital form in real-time from the X-ray images taken during measurement at different angles of rotation, and the measuring points at material transitions are detected by patented subvoxel technology.

Modern quality assurance demands that more and more geometric properties of a workpiece be measured – often by a measuring technology completely integrated into production. Compact

machines with CT sensors are now available whose performance parameters, just a few years ago, required several times the investment. They are available in two categories with different tube technologies. The one category has macrofocus reflection tubes for very rapid measuring. The other category is equipped with microfocus transmission tubes in monoblock design for high-resolution measurement. The Werth TomoScope XS machines are relatively lightweight and take up little space, so they can be installed almost anywhere.

Inline Measuring with High-Performance X-Ray Tubes

The Werth TomoScope XS FOV belongs to the first category. It features a macrofocus reflection tube with 130 kV tube voltage and high 100 W power in conjunction with a fast detector. Together with the on-the-fly mode which saves the dead time from the start-stop cycles of the rotary axis, the machine achieves the short cycle times required for inline measurement, or approximately one minute for measurement and evaluation.

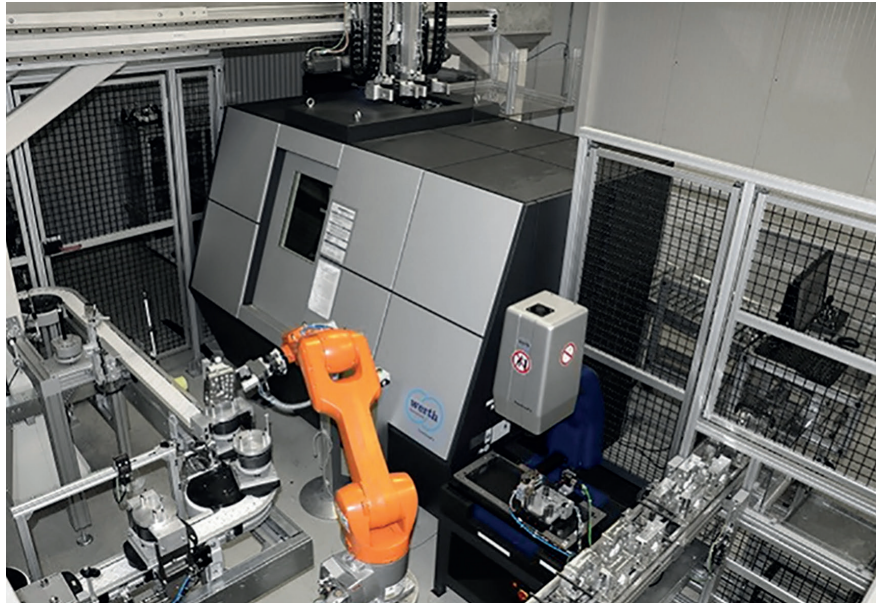
The measurement programs for inline measurement are prepared at a workstation remote from the machine. For example, workpieces are fed via conveyor belt into the safety area of a robot that loads the coordinate measuring machine automatically. Optical character recognition (OCR) identifies the workpiece and starts the appropriate measuring program. Parallel operat-

ing computers accelerate real-time evaluation with geometric property detection, 3D nominal/actual comparison, and automatic burr detection and output of the maximum burr lengths and color-coded deviation plots. The results are available on the entire network. A downstream robot sorts the measured workpieces according to status. Good parts can be expedited to the packing station on the conveyor belt, bad parts are separated for subsequent manual evaluation. Examples for the application of the TomoScope XS FOV include injection molded or extruded plastic parts.

The TomoScope XS FOV 500 with higher 500 W power in the basic configuration without moving measuring axes offers even higher measurement speeds for workpieces up to a size of approx. 200 mm. The X-ray tubes of both TomoScope XS FOV machines come with a two-year warranty with no shift limitations. A workpiece changing system (utility model) integrated into the housing is available for all compact machines that requires no additional radiation protection measures and represents a cost-effective alternative to robot loading.

Time-Saving Multi-Object High-Resolution Measurement

Werth TomoScope XS compact machines come equipped with a low-maintenance and, thus, economical microfocus transmission tube with the tube, generator, and vacuum generation in monobloc design. The high tube output enables short exposure times and correspondingly high measuring speeds. Safety-relevant workpieces and many precision products require 100 percent testing, so that measurement time is a major issue. The microfocus tube also features a small focal spot even at high power which minimizes the geometric blur caused by X-rays emanating from different points of the focal spot. At a tube voltage up to 160 kV, rapid measurement can be performed with high structure resolution to detect micrometer size defects. A resolution of less than 20 μm is achievable even at 80 W power. Application examples include plastic gears, pipettes, plastic housings, inhalers,



Automated measuring cell with robot loading for inline measurement by computed tomography.

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packaging, dental implants, or crimp contacts. High measuring speed is decisive for atline and inline measurement. With CT sensors, it can be increased even further by measuring several workpieces simultaneously. This results in a measurement time of a few seconds per workpiece. WinWerth measurement software automatically assigns measurement clouds including small objects, such as cavities, to the respective workpieces, so that problems of analysis are easier to solve.

The TomoScope XS Plus is also equipped with a Werth transmission tube in monoblock design. This machine measures several workpiece groups on different levels by Raster Tomography. One after another, X-ray images of the different workpiece segments are recorded and combined to form high-resolution overall images from which the workpiece volumes are reconstructed.

Once the injection mold (cavity, level, sprue, or side) has been set up, the workpieces can be arranged accordingly in a fixture with several levels on top of one another. Geometrical properties such as coordinates, angle, radii, or shape deviations can be calculated for workpieces grouped accordingly. The status of the individual workpieces and workpiece groups, "good", "bad", or "above action limit," is determined from all the geometrical proper-

ties and displayed color coded. The minimum, maximum, range, average value, and standard deviation of critical geometrical properties of workpiece groups can be calculated directly in the measurement software, for example, for process monitoring in plastic injection molding. Objects suitable for measurement include medium-size plastics and metal workpieces, such as bottles, insulin pens, connector housings, syringes, bone implants, and bone screws. ■

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