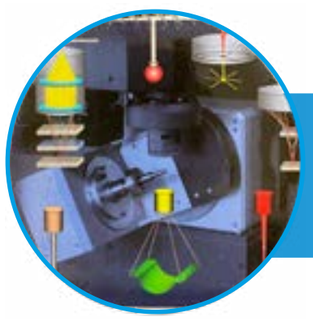


Extract taken from the book
'Multisensor Coordinate Metrology'
which was produced with the technical collaboration of Werth Messtechnik GmbH

The Changing World of Coordinate Metrology

The Changing World of Coordinate Metrology

Coordinate measuring machines are used to measure geometric features of workpieces such as lengths, diameters and angles. Some machines can also be used for additional tasks such as roughness measurements or defect inspection.

Measuring Microscopes – The First Coordinate Measuring Machines

The first coordinate measuring machines were measuring microscopes, introduced in the last century in the 20s. Around 1970, touch probe machines with automated controls were developed. Also, in the 70s, Dr. Siegfried Werth developed the Werth Tastauge (probing eye), the first optoelectronic sensor for measuring projectors, enabling the automatic capture of object points. Combined with numerically controlled axes, this sensor also enabled optical coordinate measuring machines to be automated for the first time in 1980.

Image Processing Replaces The Measuring Projector

During the 1990s, the measuring microscopes and measuring projectors that had previously dominated non-contact coordinate metrology were largely displaced by coordinate measuring machines with image processing. Significant prerequisites for this were the development of modern semiconductor cameras and the introduction of PC technology with appropriate software.

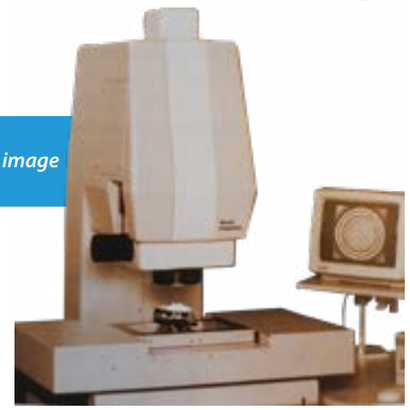


Fig 1. Werth Inspector (1987)
Multisensor Coordinate Measuring Machine with image processing and integrated laser sensor

The Changing World of Coordinate Metrology

Multisensor Systems Provide Flexibility

The additional integration of laser distance sensors led to the first multisensor coordinate measuring machines (Fig. 1). Such machines often have both non-contact and contact sensors, thus combining optical and tactile measurements. This combination makes it possible to meet the requirements of a large number of industrial applications.

The growing complexity and miniaturisation of workpieces have driven the increased relevance of optoeclectronic sensors. Their high speed capabilities allow economical measurements in a bear-production environment. Tactile sensors are, however, still indispensable for measuring certain features.

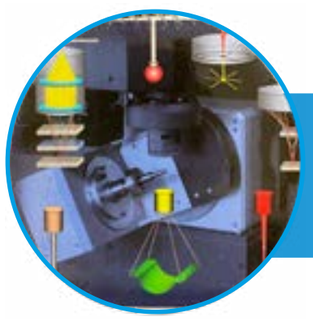
X-Ray Tomography Allows Complete Measurement

In 2005, the Werth TomoScope (Fig. 2) was introduced as the first coordinate measuring machine with X-Ray tomography (Computed Tomography). This technology opened up new measurement possibilities.

Complex work pieces with many features, including internal ones, could be measured completely in a short time. The principle of call measuring machines, regardless of sensor type, is to reduce the evaluation of dimensions, form, and position tolerances to the detection of individual points and mathematically evaluate them.

Fig. 2 : Werth TomoScope 200
The first coordinate measuring machine with X-Ray tomography – multisensor capabilities optional

for more information visit : www.werth-metrology.com



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The Changing World of Coordinate Metrology

Superposition of Sensor and Machine Coordinates

Most machines are based on a Cartesian coordinate system with linear scales.
The measurement axes are almost always powered by motors. At least once sensor is mounted on one of the axes, typically the vertical (Z ram) axis, and is used to capture measurement points on the surface of the workpiece. A common feature of all sensors is that they determine the measurement points with the reference to the sensor position.

The relative position between the sensor and the workpiece is varied by moving the mechanical axis of the coordinate measuring machine so that all measurement points of interest are captured in sequence. By superimposing the measured values of the sensor with the sensor position in the coordinate measuring machine, the measurement points are generated in the machine coordinate system (Fig. 3). These points are combined by the machine software into geometric elements (e.g. lines, cylinders) from which dimensions (e.g. distances, diameters) are derived.
These measurement results can be shown in graphical or tabular form.

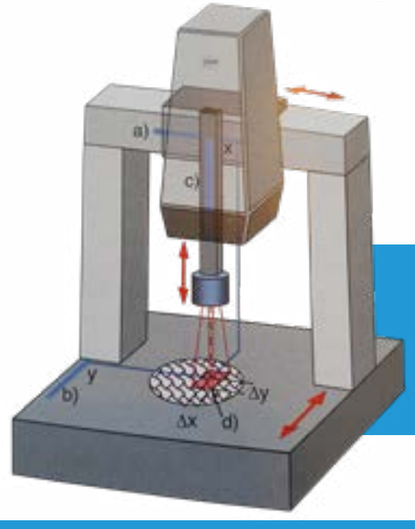

Fig. 3: Superposition of sensor measurement values and sensor position in machine coordinates, shown in the X-Y plane
a) X scale
b) Y scale
c) Z scale
d) Measurement point (x+ x, y+ y)

The Werth ScopeCheck S
Providing High Performance Metrology
on the shop floor

The Changing World of Coordinate Metrology

Flexible, Precise, and Economical Measurement

Due to its flexibility, precision and economic efficiency, modern coordinate metrology has often replaced single-purpose machines and has achieved a position of great value in quality assurance processes. The many varied functions of these machines provide the user with a great deal of potential application solutions, but require sound knowledge of their functionality and application.

In 2004, the first edition of "Multisensor Coordinate Measurement Technology" presented a comprehensive overview of multisensor coordinate metrology for the first time. Since then, aspects of this technology have also been considered in other publications, but with a focus on tactile measurement (1, 2, 3). This volume explains the technical foundations of current multisensor coordinate measurement technology.

Focus on Sensors

The focus is on the sensor technology, but important aspects of machine design, measurement applications, precision and economics are also discussed in detail.

We will be covering the next chapter soon,
however in the meantime...
Interested to learn more about *X-Ray Tomography in Industrial Metrology?*
If so then you can read more by clicking here.

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