

Inspect-360° MP

Multi-perspective dimensional accuracy and texture testing in free fall

Quality control of components with complex geometry

Inspect-360° MP examines components for outer contour and texture defects in free fall through a hollow sphere from up to 27 perspectives. The system can be used without a setup process or component-specific handling.

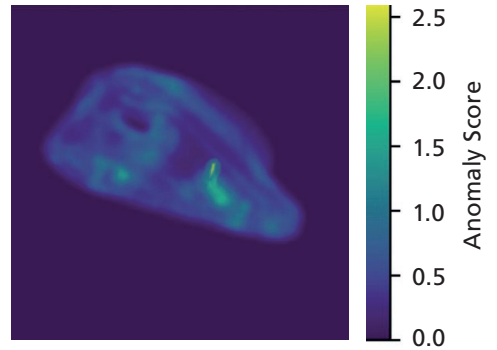
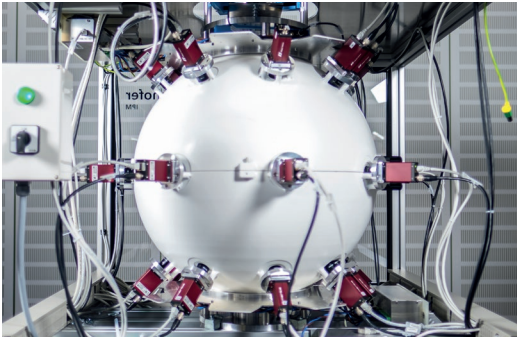
Manufacturers of cast or milled parts are increasingly required to inspect and document 100 percent dimensional accuracy and surface finish of parts. Automated inspection requires specific component handling, which makes the inspection process slow and uneconomical. Fraunhofer IPM's optical inspection system Inspect-360° MP examines the entire surface of components in free fall – regardless of type and without specific handling. In the process, Inspect-360° MP also detects hard-to-reach areas of complexly shaped components.

Testing without specific component handling

Today, visual inspection of components during production is common practice in quality control. Automated inspection of components with complex geometry and demanding defect features usually fails due to slow and expensive robot handling. Inspect-360° MP enables a largely type-independent inspection of such components without additional handling: The parts to be inspected are transported individually into a hollow sphere via a conveyor belt at one-second intervals. As they fall freely through the sphere, they are simultaneously recorded from all directions by 27 cameras, regardless of their orientation. The parts are diffusely illuminated and appear free of shadows and reflections, even if the surface is bare or coated with oil.

With the help of real-time image processing, the 2D images captured from different perspectives are mapped to the existing CAD model and evaluated directly after capture. For each 2D image, the deviation of the outer contour from the CAD model of the respective view is calculated. Dimensional accuracy errors can thus be detected immediately.

The texture of the parts is analyzed using AI-based anomaly detection. Anomalies on the surface can thus be detected quickly, which is a great benefit for many applications. Only good parts are required for training the neural network, so there is no need for a time-consuming search for defective parts in advance. For example, scratches, stains and cracks are detected very quickly with the method. A downstream



During visual inspection, areas that are difficult to access visually are viewed from different directions. Using the same principle, Inspect-360° MP captures images from up to 27 perspectives simultaneously and evaluates them automatically.

Inspect-360° MP detects defects in places that were previously difficult to inspect automatically – regardless of the orientation and position of the component. The scratch above the hole is reliably detected. The color indicates the deviation from the nominal value.

classification of the defects is possible. The evaluation takes place at one-second intervals, so that defective parts can be sorted out directly.

As a matter of principle, areas entirely located on the inside cannot be inspected. However, a simulation tool can be used to check in advance the extent to which transition areas from outside to inside surfaces can be reliably inspected. This means that the number and orientation of the perspectives can be adjusted as required.

Complete testing despite complex geometry

Independent of material and type

Similar to visual inspectors, Inspect-360° MP inspects the component from numerous perspectives to identify all potential defect locations. The 27 cameras are evenly distributed over the surface of the hollow sphere and directed at the center of the sphere. Regardless of the position and orientation of the component in free fall, each section is thus recorded at least once.

Inspect-360° MP is suitable as an alternative to visual inspection for components ranging in size from cubes to fists. Different component types can be inspected with a single system – from cast, milled or forged parts to injection molded and formed parts and composite parts. Dimensional and textural defects as small as 100 µm are identified on objects with a diameter of 100 mm. The inspection is performed inline during the production cycle, allowing direct intervention or feedback into the process.

Often, on nearly symmetrical components, such as shafts or sleeves, there are features that are difficult to detect, such as markings, butt edges or burrs, which interrupt this apparent symmetry. The high number of perspectives enables the system to detect these features and thus also to precisely compare the dimensional accuracy of nearly symmetrical components with the CAD model.

Typical system properties

Size of object	min. 20 × 20 × 20 mm ³ max. 100 × 100 × 100 mm ³
Size of surface defect	min. 100 µm
Cycle time	1 Hz
System dimensions inspection unit	1.2 x 1.0 x 1.0 m ³ (h/w/d)
Number of cameras / inspection perspectives	27
Lighting	monochromatic, diffuse

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