

Inspect-180°

Multi-perspective dimensional accuracy and texture testing on the conveyor belt

Inline quality testing of large components

Inspect-180° examines the outer contour and texture of components with up to 100 cm in diameter. During inspection, the parts are positioned on a conveyor belt and travel through an inspection tunnel equipped with several cameras. The system can be used without a setup routine or component-specific handling.

Manufacturers of cast, deep-drawn or stamped parts are increasingly faced with the need for 100 percent inspection and documentation of dimensional accuracy and surface finish of the parts. The inspection involves specific component handling, e. g. via robot. This makes inspection processes both slow and inefficient, as handling must be adapted depending on the component. Inspect-180° by Fraunhofer IPM inspects component surfaces on the conveyor belt, independent of the component type and with no need for specific handling.

Component testing without the need for specific handling

Visual inspection parallel to the manufacturing process is still common practice in quality control of components with complex geometries and demanding defect characteristics. This is because automated component inspection often requires slow and expensive robotic handling. Inspect-180° enables automated inspection of such components. The optical system works largely independent of the component type and does not require additional handling. The parts to be inspected are positioned on a conveyor belt and fed one by one into an inspection tunnel. As the parts move through the system, they are captured by several cameras multiple times and from different

perspectives. Each camera can be focused individually so that the entire surface of virtually any arbitrarily shaped component can be captured sharply in any orientation. Diffuse lighting ensures that even components with a glossy surface or oil coating are recorded without shadows or reflections. The parts travel through the inspection tunnel within a few seconds.

Real-time image processing is performed to map the 2D images captured from different perspectives to the existing CAD model immediately after capture and evaluate them. For each 2D image, deviation of the outer contour from the CAD model of every given perspective is calculated. The component's surface texture is analyzed by means of AI-based anomaly detection, immediately revealing defects such as scratches, stains or



As with visual inspection, components – here a formed sheet metal component – are inspected from several perspectives. The automated image evaluation shows typical defects such as cracks, scratches or dents.

cracks. The training of the neural network requires only good parts, which eliminates the need for a time-consuming search for defect parts prior to training the network. A downstream classification of the defects is possible. The evaluation is performed within a few seconds, so that defective parts can immediately be sorted out.

Comprehensive testing despite of complex geometry

Similar to a visual inspector, Inspect-180° examines the component from numerous perspectives to identify all defects at any potential location. The cameras are evenly arranged over the surface of the inspection tunnel and focused on specific areas of the inspection volume. This means that, regardless of the component's position and orientation, each section of the component's surface area is recorded at least once as it passes through the tunnel.

As a matter of principle, the underside of the component as well as areas entirely located on the inside are excluded. A simulation tool may be used to check in advance the extent to which transition areas from outside to inside surfaces can be reliably detected. The number of cameras and their orientation can be adjusted as required.

Measuring with sub-millimeter precision in the production line

Inspect-180° is an alternative to visual inspection for components up to 100 cm in diameter and with complex geometry, such as formed sheet metal parts. Dimensional accuracy and texture defects larger than 0.5 mm in size can be detected. A variety of parts can be inspected using one single system, without the need to adapt the hardware. Component testing is carried out at the speed of production, allowing direct intervention or feedback into the process.

Typical system properties

Inspection volume	min. 15 × 15 × 15 cm ³ max. 100 × 100 × 50 cm ³
Detectable defect size	min. 0.5 mm
Inspection cycle	5 seconds
System dimensions	2.9 × 4.0 × 3.6 m ³ (H/W/D)
Lighting	monochromatic, diffuse
Object surface properties	mat, reflective, textured, coated

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