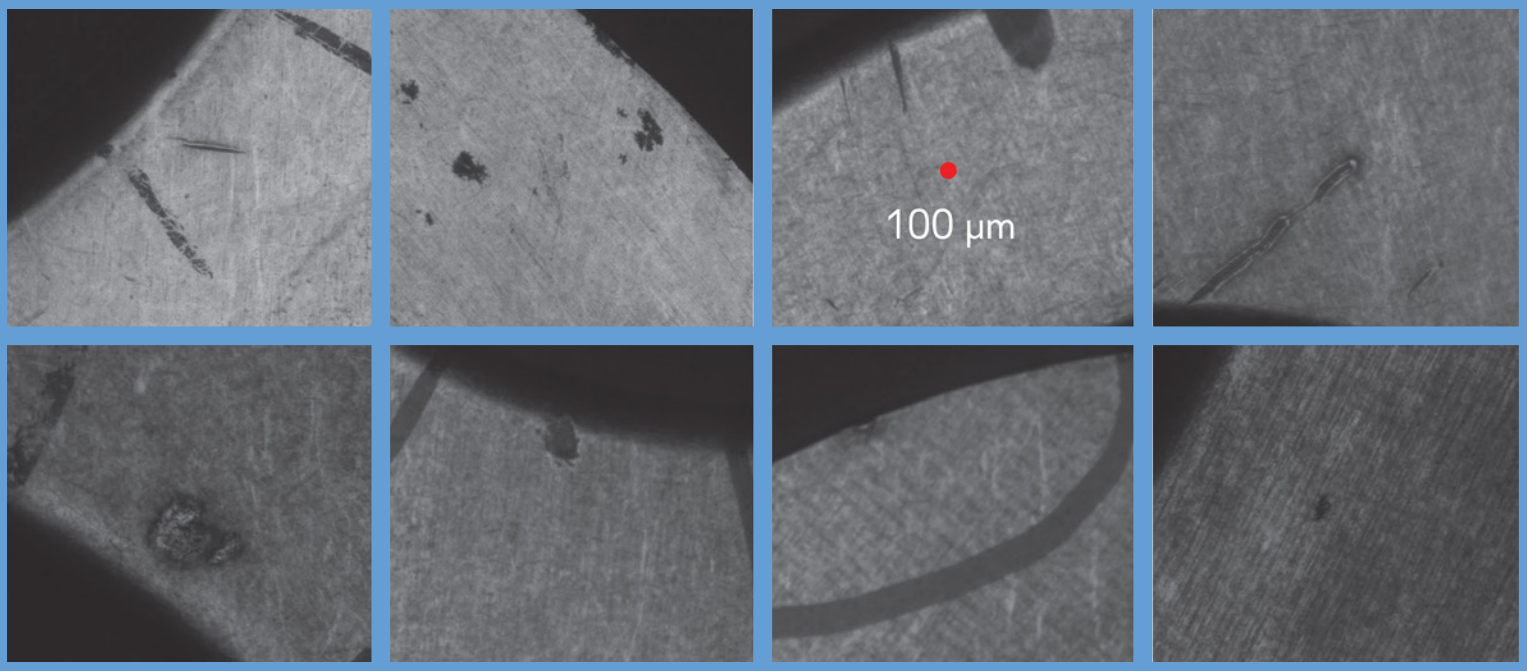


Surface Inspection

Checking for surface defects is an important component of measuring product quality characteristics. Increased productivity leads to accelerated production processes and so production technology is used to the edge of its effectiveness, significantly increasing the risk of a nonconforming product.

› Quickly and sharply look at each piece of surface

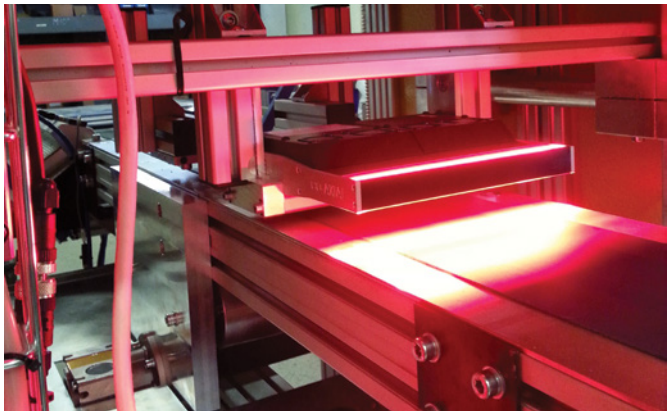
Surface defects are a very specific phenomenon. Despite the apparent harmlessness, they can have a significant negative impact on a product's functional characteristics, or leave the impression that an end customer's operations are malfunctioning. Rotating parts are particularly very sensitive to surface defects.
Detecting surface defects is one of the most demanding inspections encountered, so special optical and lighting systems are utilized to detect them. High speed and inspection resolution are the main requirements. Often, the goal is to detect very small surface defects measuring tens of microns. Some surface defects can only be detected by a change in the relief. Here, direct or hybrid 3D technology is used (laser scanning, collimated illumination, and Shape-from-Shading).

› Advantages and Benefits

- Provides a very high resolution of the sensed image;
- High system flexibility;
- Combines different sensing methods;
- Moves along the product at a high speed during sensing;
- Inspects all production;
- Customers develop the optical and lighting systems;
- Optimizes solutions for specific applications.

Types of Defects

- Detects surface defects
  - Stains, dirt, rust
  - Traces of deposits and phosphates
  - Traces of machining; grooves
  - Porosity
- Detects shape defects
  - Bruises
  - Missing material
  - Cracks
- Inspects shape and dimensions
- Checks for the presence of holes, lugs, etc.



DATALAN QUALITY INSTRUMENTS s.r.o.
Púchovská 8, 831 06 Bratislava, Slovakia
T +421 2 323 70 000
info@dqi.sk | www.dqi.sk

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› System parameters

Camera system resolution	From 10 µm
Material scanning speed	Up to 1,000 mm/sec
Size of the smallest detectable defect	From 50 µm (depending on application)
Speed of assessment and sorting	> 10 pcs/sec. (depending on application)
Number of cameras per station	Up to 8
Size of the database of sorting programs	Unlimited

› Method of Measurement

Surface defects are detected mainly with 2D camera systems. They mainly utilize line cameras for better integration, higher overall image resolution, and easier achievement of homogeneous illumination.

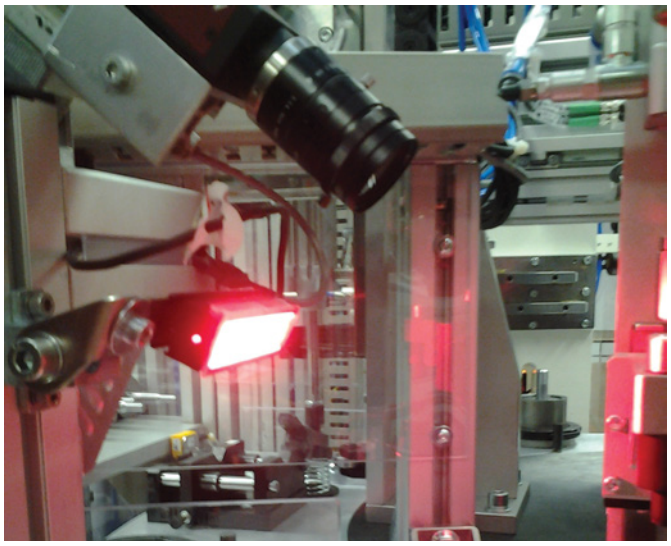
A key task is to configure the lighting to focus on found defects and to smooth the surface to its specified properties. Here, the following lighting configurations are mainly applied:

- Diffusion – to detect contrasting defects (dirt, rust);
- Collimated – to detect changes in the shape of the surface, non-contrasting;
- Low-angle – to detect cracks, protrusions, torn material;
- Infrared – to eliminate pigments and printing.

› Special Applications

Surface checks include the running of special applications covering the following areas:

- Optoband – checking bearing surfaces;
- BoreView 360 - inside brake cylinder grooves;
- Checking for plastic foil defects;
- Checking clutch and brake linings;
- Separate interoperable sorting device;
- Inline device integrated in the production process;
- Continuous measurement of products on conveyors;
- Discrete rotary system measurements;
- Sensors integrated into the assembly station;
- Scanning of static products.



› Data Processing and Visualization

Defects are always evaluated in two steps, i.e. segmenting and qualifying. Our system allows searches for various kinds of defects, independent assessment of them and an evaluation of their impact on the product quality. All results are visually and statistically shown to operators and engineers. The system creates a database of product images for easier reverse-setting of sorting parameters.

› Integration Options

The surface inspection integration process depends on the flow of material and the way nonconforming products are sorted out. It can be used to sort OK/NOK products on an existing production line or to provide feedback to upstream production technology sections. Likewise, the system can operate as a stand-alone sorting device.

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