



Optical Reflection and Eddy Current Combined

Robotic Surface Inspection with the Optical Reflection Sensor by ibg

Author: Wolfgang Korpus, CTO at ibg

The iORS sensor introduces a new, fast, and easily automatable approach to detecting defects on high-quality steel components such as rings, rollers, and balls. It employs a second physical principle, optical reflection, in addition to the established eddy current technology, enhancing accuracy and precision.

One of the main tasks and challenges in surface inspection is identifying flaws such as so-called black spots (unpolished areas), breakouts, pores, or relevant contaminations that can affect the lifespan and reliability of steel components.

To address this, ibg, a globally active manufacturer of non-destructive ma-

terial testing technologies, presents its latest innovation: the optical reflection sensor, iORS. This sensor works in conjunction with the Eddyvisor testing devices from the manufacturer, a family of high-performance signal processing units. The iORS sensor offers a new and user-friendly solution for seamless detection of surface defects on functional surfaces of steel compo-

nents such as rings, rollers, and balls for the bearing industry or on sealing surfaces of pneumatic and hydraulic components.

With the iORS sensor, the manufacturer has developed a new, fast, and easily automatable approach to defect detection, which is based on the reflection of light, a second physical principle, in

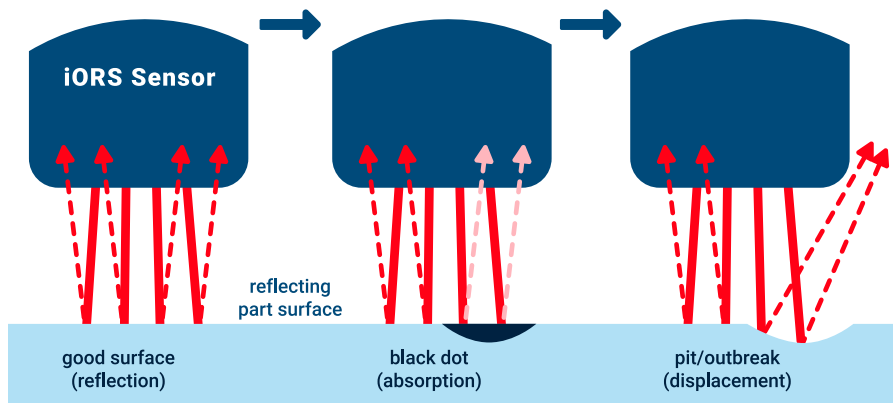
addition to ibg's core competence, the proven eddy current technology, providing enhanced accuracy and precision.

The iORS sensor employs advanced optical reflection technology to detect surface defects with high sensitivity and accuracy. It emits a beam of light, captures the light reflected from the surface, and analyzes, based on the differential principle, whether irregularities or defects on the surface have led to a localized reduction in the reflected light intensity due to absorption or deflection. This non-contact testing approach enables the detection of even small defects that could be overlooked by other testing methods, ensuring a high level of safety in quality inspection. Simultaneously, it provides an appealing alternative to time-consuming manual inspections or costly and complex vision systems.

In Combination with Other Probes

What sets the iORS sensor apart is its unique ability to work in parallel with ibg crack detection probes connected to the same Eddyvisor evaluation unit. This combination allows component manufacturers to benefit from the advantages of simultaneous use of optical reflection scanning and eddy current crack detection, optimizing throughput performance and inspection times while conserving investment budgets.

The iORS sensor, in conjunction with the testing devices, offers an intuitive,



Operating Principle of the iORS Sensor: emitted light is intensely and uniformly reflected by good surfaces. In contrast, the quantity of light in flaw areas on the surface is reduced due to absorption and deflection. This difference is evaluated using the differential principle, leading to the decision of non-conforming (NOK) inspection. @ibg

user-friendly interface and utilizes ibg's Good-Part-Teaching concept, a machine learning approach, as well as the Preventive Multi-Filter Testing Evaluation (PMFT) through 30 filter bands and automatically shaped tolerance fields.

„We are excited to introduce the iORS sensor as a thrilling addition to our multimodal Eddyvisor universe,“ says Wolfgang Korpus, CTO at ibg. „The capability of the iORS sensor to work hand in hand with our proven crack detection probes opens up new avenues for the simultaneous application of optical reflection scanning and eddy current crack detection.

This provides our customers with a powerful, integrated solution for surface defect detection on steel components, which has not been available before.“

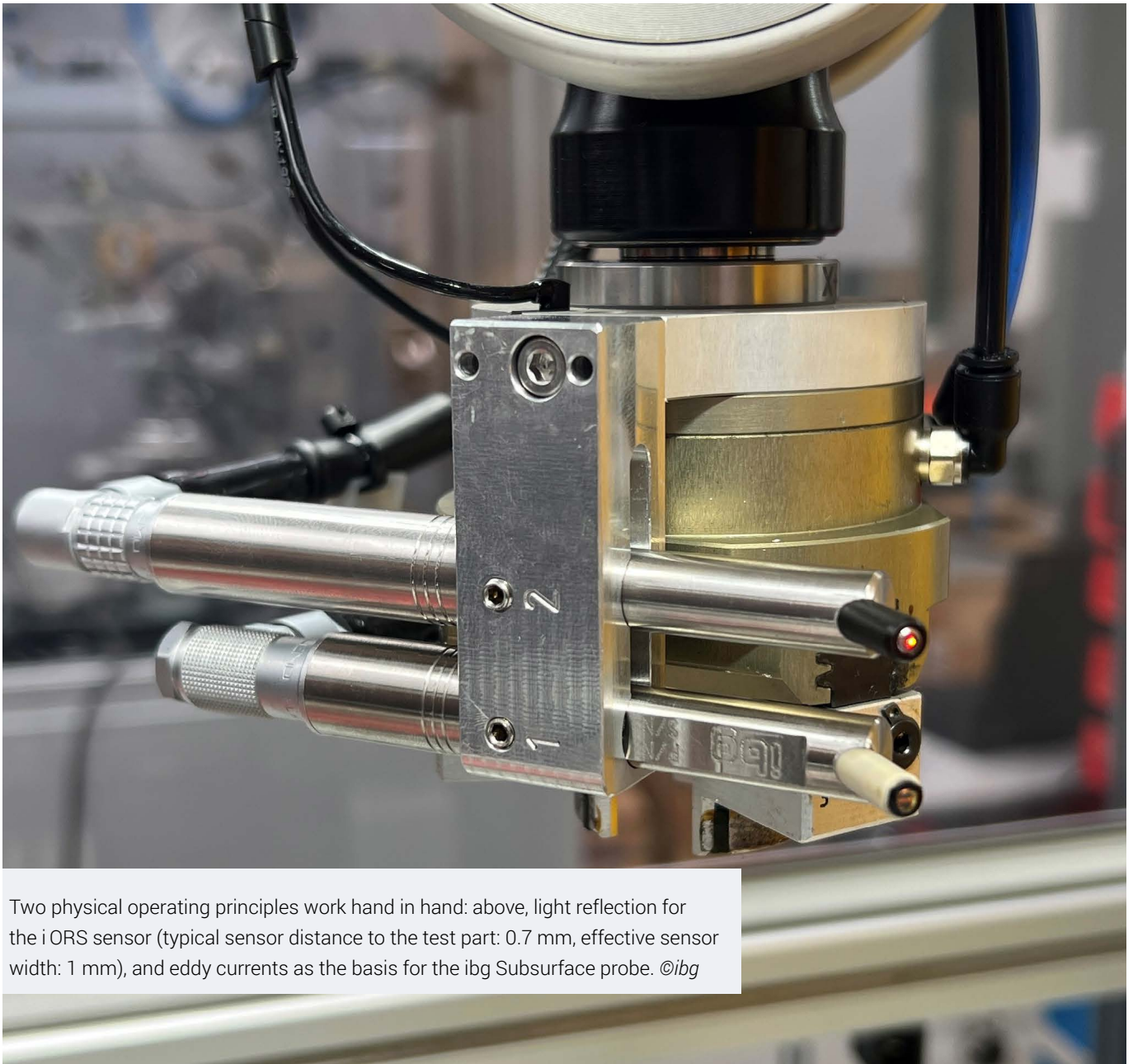
The sensor is well-suited for a variety of applications in the component manufacturing industry, including bearings, the automotive sector, aerospace, and other demanding industries where the quality and reliability of steel components are of paramount importance.

A Robot for More Efficient Deployment

The suitable companion for the new generation of sensors for a one hundred percent inline quality control is the inspection system concept, Eddyrobot. In this system, the manufacturer cleverly combines the performance, precision, and flexibility of modern six-axis robots with advanced sensor technologies in a modular concept, providing a well-thought-out solution for defect detection in manufacturing processes. This leads to higher test security and ultimately an improvement in end products. The eddyrobot



Surface contamination on the ball raceway of a wheel bearing inner ring in overview and close-up, along with the corresponding C-image from the Eddyvisor test instrument after completion of the inspection. @ibg



Two physical operating principles work hand in hand: above, light reflection for the iORS sensor (typical sensor distance to the test part: 0.7 mm, effective sensor width: 1 mm), and eddy currents as the basis for the ibg Subsurface probe. ©ibg

operates autonomously integrated into production lines, reducing the influence of the human factor and ensuring the consistency and accuracy of inspections.

To offer its customers the best possible solution, ibg once again relies on the longstanding partnership with Stäubli Robotics, a specialist in robot-assisted automation solutions, for the Eddyrobot product family. This collaboration combines ibg NDT Technology's sensor and evaluation expertise with Stäubli's robot technology, creating an extremely efficient robot-based testing system distinguished by exceptional

speed and precision. It not only simplifies the testing process but also ensures consistent and reliable results for a diverse range of components to be tested.

What truly distinguishes the Eddyrobot is its dual sensor configuration. The robot skillfully handles both an ibg Subsurface Eddy Current probe for subsurface defects as well as the Optical Reflection Sensor (iORS), highlighting its versatility and broad defect detection capabilities on and beneath the surface. The subsurface probe sends magnetic fields onto the surface, generating eddy currents up to a depth of 1

to 2 mm in the steel component. This allows detection of subsurface defects such as non-metallic inclusions, which can occur due to contamination during steel production, in addition to surface-open cracks and pores. These are defects that other testing methods may not be able to uncover or can only partially detect.

The essential design requirement for Eddyrobot development was high flexibility combined with floor space efficiency to require the smallest possible footprint in production. Its adaptable design facilitates the testing of various part types within a part family, enabled

by a parametric programming concept. The Siemens PLC used in Eddyrobot calculates the corresponding robot commands at runtime, eliminating the need for fixed programmed robot routines and enabling operators to create new testing programs easily - even without the direct support of robot experts.

These are compelling reasons why ibg customers from the wheel bearing sector in Asia and North America have already chosen Eddyrobot inspection systems as specialized solutions for inspecting bearings, a crucial component in the automotive sector where the importance of reliable testing technology cannot be underestimated. Bearings serve as the literal pivot point on which mechanical systems rely, and even the slightest defect in this area can have dramatic consequences, from impaired performance to safety risks.

Conclusion

In summary, the eddyrobot represents a significant advancement in the field of non-destructive testing, marking a special milestone in its development. It combines precision, automation, and innovation, providing fresh perspectives for defect detection across various industries. With its ability to uncover hidden defects, the system ensures the integrity and safety of critical components, paving the way for a more reliable future in manufacturing.

In parallel, the optical reflection sensor iORS offers new possibilities for inspecting steel surfaces.

It delivers high precision, reliability, and versatility without the complexity and costs associated with elaborate image processing systems. Moreover, the iORS works seamlessly with the

Eddyvisor crack detection sensors, enabling simultaneous optical reflection scanning and eddy current crack detection at manageable costs. This combination significantly enhances efficiency and productivity in fully automated quality control processes.

Author: Wolfgang Korpus,
CTO at ibg

Contact:

ibg Prüfcomputer GmbH
Pretzfelder Straße 27
91320 Ebermannstadt
Germany
Tel: +49 9194 7384 -0
info@ibgndt.com

