![Fraunhofer IWS logo]

SURFinpro

AI-based Optical Surface and Defect Analysis for Continuous Production Processes

Fast and automated defect detection on surfaces is crucial for a wide range of production processes like roll-to-roll processes in, for example, photovoltaics. The SURFinpro system solves this task by combining an optical sensor with an AI-based analysis chain. This allows both the micrometer-precise acquisition of three-dimensional surface information and its evaluation for process in real-time. If required, the system can be connected to the control system of a production process.

Features

- SURFinpro uses artificial intelligence and optical measurement technology to detect, classify, visualize, and report defects to the producing plant in real-time
- Captures surfaces three-dimensionally in high resolution and generates further information in-line with the running production
- Classifies defects and provides additional parameters such as defect density, geometric dimensions, and frequency of defects
- Maximizes optimization potential in production

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Greater Accuracy at Higher Speed

The Fraunhofer Application Center for Optical Metrology and Surface Technologies (AZOM) in Zwickau is a branch of the Dresden-based Fraunhofer Institute for Material and Beam Technology IWS. Researchers have developed a system that - supported by artificial intelligence - detects and evaluates surface defects, artifacts, and texture changes. SURFinpro enables more precise and faster execution of production processes. The system analyzes films in roll-to-roll processes with a width of 70 centimeters and detects surface defects, artifacts, and texture changes in the process in real time. It can quickly record surfaces in three dimensions with high resolution and use this measurement data to generate further information in-line for ongoing production.

## Adaptable for Different Fields of Application

SURFinpro offers flexible adaptability and suits various fields of application. The technology adapts to continuous manufacturing processes for fiber composites to avoid surface defects and to detect and evaluate components in multiple dimensions. The semiconductor industry may also benefit from the algorithms and the system for defect classification.

Faster Evaluation through Artificial Intelligence

SURFinpro uses machine learning techniques to speed up evaluation. Using neural networks that get by with smaller amounts of data and new training strategies, SURFinpro ensures accurate, dynamic, and reliable defect detection. Fraunhofer AZOM researchers are continuously developing new technologies to extract the same amount of information from fewer data at higher speeds.

Sophisticated Modularity

SURFinpro is characterized by its modularity. The system builds on a modular principle with efficient components. The individual building blocks have been developed to fit effectively nto different contexts and projects. This structure allows flexible and adaptable use of the measurement system for a wide range of applications. With more precise defect detection, faster evaluation, adaptability, and smart modularity, SURFinpro, therefore, qualifies for the optimization and quality control of different production processes.
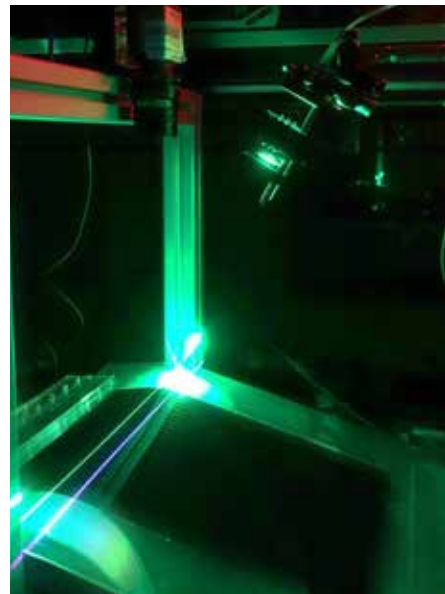
Using artificial intelligence and optical measurement technology, SURFinpro detects, classifies, and visualizes defects in the process in real time.

Comparison of the time required for a deterministic and an alternative Artificial Neural Network (ANN) model, with an increase in the number of image segments considered. The theoretical curves are backed by the experimentally recorded processing times. Thanks to the use of the weak saturation of the ANN curve, the required processing time of about 4 ms (250 fps) can be achieved even for a higher number of segments