

TexCam

Automated texture analysis

High-resolution, large-area and flexible

The inspection system TexCam enables an automated texture analysis. By using pixel shifting technology, TexCam reaches high resolutions with comparably large measurement fields – even with complexly formed surfaces.

Imaging methods for inspecting surfaces soon reach their limits when it comes to quickly recording and analyzing large surfaces at high resolution. The inspection system TexCam for automated texture analysis records surfaces using a high-resolution camera and modern pixel shifting methods at an extremely high resolution and with a comparably large measurement field.

Fine textures on large surfaces

The resolution of industrial cameras is generally limited to 50 megapixels (MP). Higher resolutions can usually only be reached at the expense of pixel size and that normally goes hand in hand with lower light sensitivity. Until now, it has therefore either not been possible to record slight defects or textural differences in the microstructure of an object, or only with a great deal of effort. It is often necessary to scan the desired measurement field, which only causes further problems. For example, the camera or the object must be traversed with precision, and it becomes necessary to carry out time-consuming calculations when combining the individual images (stitching), since acquisition characteristics such as perspective and lighting differ across the measurement field.

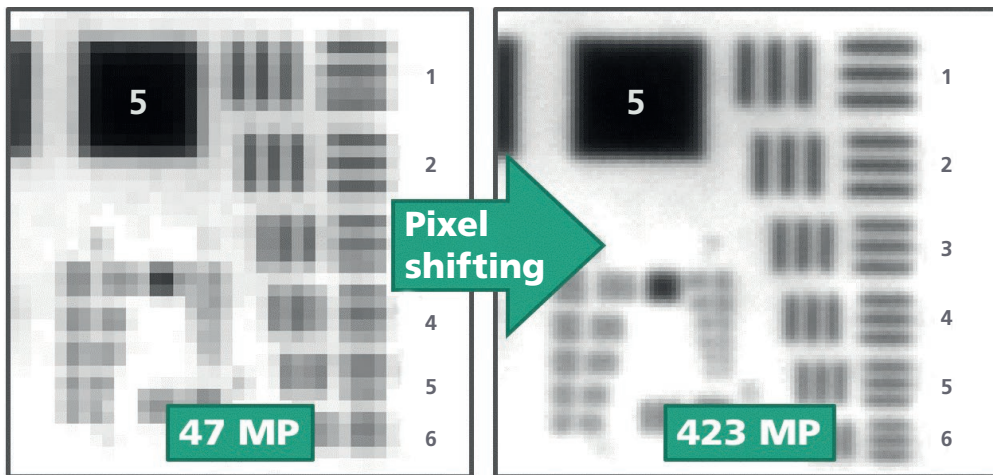
With TexCam, Fraunhofer IPM offers a flexible, robot-assisted (depending on use) inspection system that solves these problems: A high-resolution camera increases the resolution of an overall image recording up to ninefold by rapidly and precisely shifting the image sensor (pixel shifting, see image overleaf). That's how TexCam can either reach extremely high resolutions with comparably large measurement fields (e.g., 5 µm / pixel at 100 mm × 80 mm) or very large measurement fields at high resolution (50 µm / pixel at 1 m × 0.8 m).

Extremely high resolution thanks to pixel shifting

TexCam' central component is the camera with pixel shifting technology. In order to increase the resolution of a complete recording, the recording is done in a sequence with up to

Advantages at a glance

- Recording microstructures even on a large measurement field
- Extremely high resolution thanks to pixel shifting
- Detecting a variety of textures and texture defects
- Microstructure-based defect detection and localization via machine learning
- Flexible measuring setup with robot handling, adjustable measurement field and adjustable lighting



Pixel shifting: The high-resolution TexCam camera increases the resolution of an overall image recording up to ninefold by rapidly and precisely traversing the image sensor.

The figure shows the 5th group of a USAF 1951 test chart according to MIL-STD-150A, displaying a detail from a recording with a measurement field of around 110 × 80 mm².

nine individual images which are then combined. For each of these individual images, the image sensor is shifted laterally in 1/3 pixel steps in both directions within a matter of milliseconds by means of an integrated nano stage. Traversing the camera or the object externally is not required, and computationally intensive stitching of individual images is no longer necessary. Equally, the perspective and lighting remain unchanged during each of the individual recordings.

The complete recording has a resolution of 423 MP, as the figure above illustrates. This huge quantity of data poses a huge challenge for the automated processing that follows. Nevertheless, a frame and evaluation rate of up to three images per second at full resolution is achieved through the use of the high-speed interface CoaxPress 2.0 and the subsequent parallelized, GPU-accelerated analysis.

Rapid microstructure and surface analysis

The TexCam inspection system enables rapid microstructure or surface analysis on the flat surfaces of almost any structure or material. That could be the recognition of microcracks in metal materials or defects in woven textiles, for example.

TexCam is also suitable for the inspection of photolithography plates used for the production of electrical components, or for the inspection of entire printed circuit boards (PCBs). Even inclusions in natural materials such as wood or cork can be detected thanks to the high resolution. In practice, TexCam analyzes all materials in which potential surface defects are noticeable due to a change in its microstructure.

One inspection system, a multitude of possibilities

The system's flexible design is easily adapted, making the inspection of different objects possible. The robot-assisted handling facilitates a simple and precise recording of the object. Both optics and lighting can be adjusted thanks to the modular structure, to best highlight individual textures and defects. The software, which is customized for each use, provides an automated image recording and allows for evaluation on the basis of typical texture analysis algorithms and high-efficiency AI methods (in particular deep learning).

Contact

Dr. Tobias Schmid-Schirling
Group Manager
Inline Vision Systems
Phone +49 761 8857-281
tobias.schmid-schirling@ipm.fraunhofer.de

David Joel Regina
Project Manager
Phone +49 761 8857-271
david.joel.regina@ipm.fraunhofer.de

Fraunhofer Institute for
Physical Measurement
Techniques IPM
Georges-Köhler-Allee 301
79110 Freiburg, Germany
www.fraunhofer.de/en