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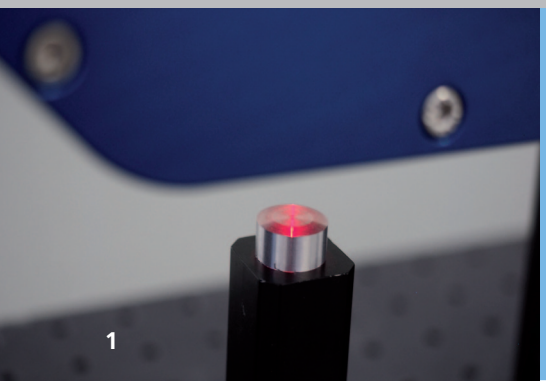
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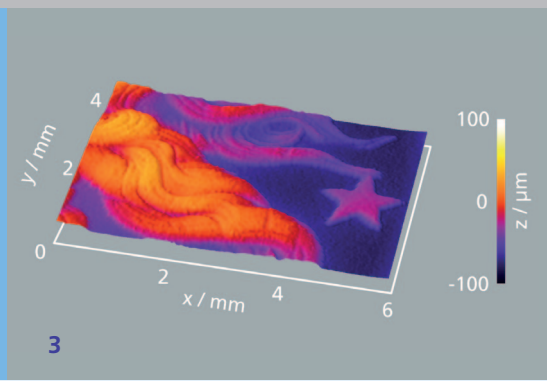

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1 HoloTop detects the topography of surfaces quickly and reliably enough for inline inspections.
2 / 3 Surface measurements of coins demonstrate the potential of high-resolution topography measurements with HoloTop.

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HOLOTOP

3D INLINE MEASURING TECHNOLOGY

Macroscopic topography measured with microscopic precision

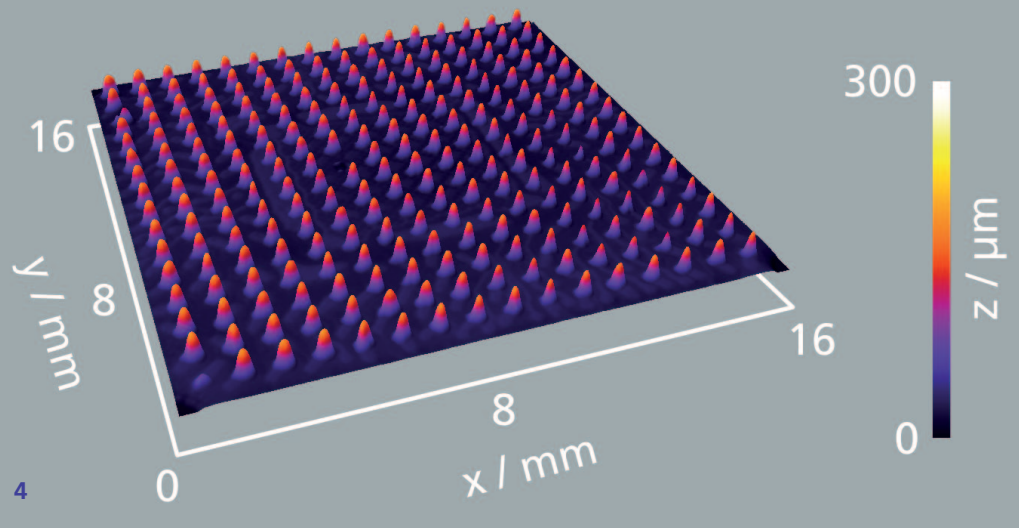
Precision and safety demands on machines and components are increasing steadily. This is especially true for high-tech industries, such as aerospace and medical technology and for mass-produced parts in the automotive industry. In either case, it is important to measure each individual component precisely during production, to avoid unnecessary waste or recalls of entire high-value systems. Complete inspection, measurement and documentation of all components will soon be standard practice. In many cases, the precise shape of components is essential for their function. In current mass production, a 100% quality control of many important parameters is only feasible qualitatively. Precise, quantitative measurements are possible only for a small random sample. This is no longer sufficient for the comprehensive demands of modern quality control.

Precise surface measurement and defect recognition

With HoloTop, Fraunhofer IPM offers an optical system for 3D inline measurement of surfaces based on digital holographic microscopy. HoloTop makes contactless, highly precise measurements of component surfaces. It records the topography of rough object surfaces with interferometric precision. The measuring system is so fast and robust that it can be used for inline inspections. This is possible thanks to the use of multi-wavelength holography.

Measuring with digital multi-wavelength holography

Through the use of narrowband lasers various synthetic wavelengths are employed. These different measurement wavelengths give access to a broad measurement spectrum from the (sub)micrometer to the mil-



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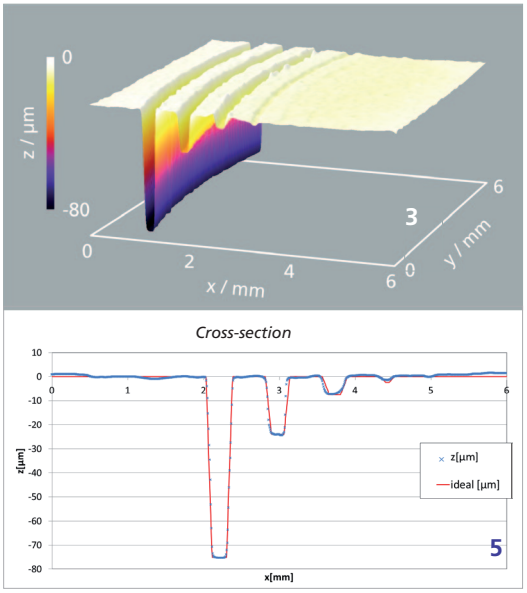
limeter range, depending on roughness. The measurement resolution and reproducibility depend on the distances between the individual wavelengths used and the surface properties of the object and can be adapted to the specific application.

Other interferometric methods for surface inspection often fail to measure complex structures such as steep slopes, deep grooves, high edges and holes. If the object has steep edges, the height relief can no longer be clearly analyzed, because the phase jumps lie too close together.

Digital multi-wavelength holography solves this problem: a large virtual wavelength is used as a coarse, unambiguous measurement. This information is combined with precise measurements using smaller wavelengths, resulting in a high resolution.

Speed is another advantage: The camera-based measurement takes just a fraction of a second measuring the entire object surface in a single step without scanning. Short measurement time combined with precision on a micrometer scale makes the process suitable for use in industrial environments.



4 *Topography of a ball grid array. The inline measuring system inspects ball grid arrays with 9 megapixel resolution and 10 Hz imaging rate.*

5 *Image of a calibration standard. The diagram compares the measured data along the dotted line with the reference shape of the standard.*

Applications

- 3D surface measurement of components in the production process
- quality control of high-tech products, such as in aerospace and medical technology, or in automotive production

Advantages

- macroscopic topography with a depth range of 5 mm and precision into the µm range
- complete quality control
- lower testing costs due to automatic inspection
- use in industrial surroundings due to short measuring time
- measurement of heterogeneous surfaces of one and the same object

Technical Specifications	
Measuring field	*up to 30×30 mm²*
Resolution	*axial 1 µm (1 σ)* *lateral < 7.5 µm* *scalable*
Measuring time	*< 100 ms (+ 150 ms data analysis) at 9 megapixel*
Working distance	*up to 300 mm*