3D measurement system with integrated USB 2.0 camera:

Some like it white

There are many techniques to measure surfaces in three dimensions. Thanks to the improvements by image processing, mainly contact-free measurement systems are on the rise. 3D-shape's new product µKORAD^{3D} is an example, which uses MATRIX VISION's industrial camera mvBlueFOX as the optical component.

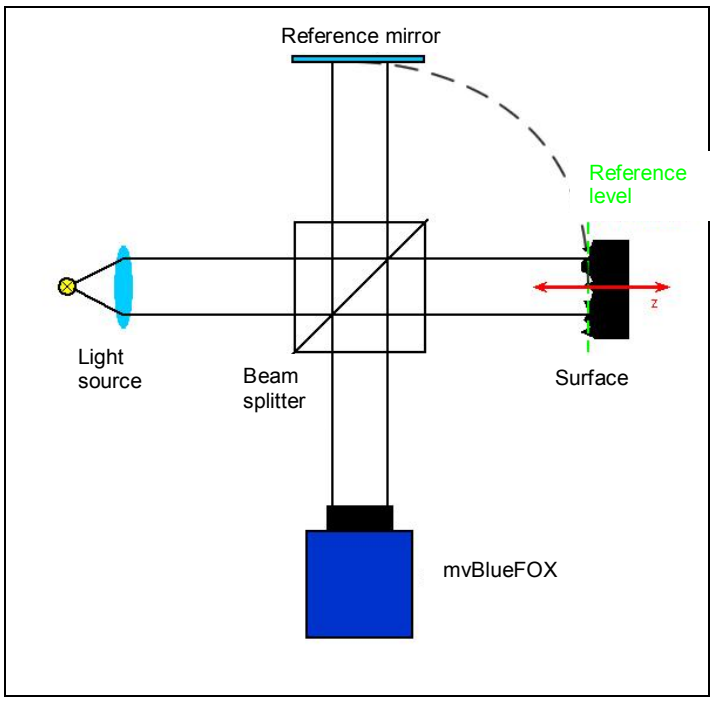

Figure 1: Simplified diagram of the white light interferometer's functional principle.

The measurement method of µKORAD^{3D} is based on the principle of white light interferometry. In contrary to the general interferometry, which is based on laser light, the white light interferometry is able to measure areas with ranks or even rough surfaces.

With the lower coherence of the wide-band white light, the error of measurement is situated in the nano area.

Measurement method

A white light interferometer consists of several components: a light source, a beam splitter, a reference mirror and a camera. The light source is splitted up by a beam splitter, whereas one beam is redirected and reflected to the reference mirror, the other to the object, which will be measured. Both reflected beams interfere with each other to an interference image. The distance between reference mirror and beam splitter makes the fictitious reference level from beam splitter into the direction of the object (Figure 1).

By the use of small object shiftings in z direction, the

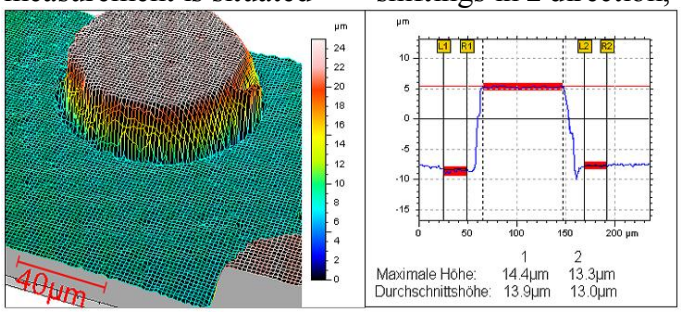

Figure 2: 3D measurement result of an electronic part (3D-Shape GmbH)

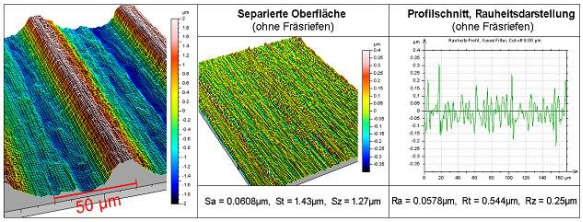

Figure 3: Metal surface with milling grooves (3D-Shape GmbH)

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mvBlueFOX

The mvBlueFOX with a size of 38.8 x 38.8 x 58.5 mm (width x height x length) is a compact industrial camera with USB 2.0 interface. Area scan sensors are available, CCDs up to 1600 x 1200 pixels ans CMOS' up to 1280 x 1024 pixels.
Furthermore, the camera contains two digital I/Os and lens holder for C-, CS-, S-Mount lenses. For time critical I/O and acquisition there is a Hardware Real-Time Controller (HRTC).
Additionally for developping own application, mvIMPACT Base library is included in the scope of supply. Especially for OEMs, the industrial camera mvBlueFOX is available as a manageable and flexible camera module.

Figure 4: optical component mvBlueFOX

interference image is changing. This is noticed by the camera in the form of brightness fluctuations. In doing so, you have to notice that an interference pattern will only occur, if the distance difference between reference mirror and object surface is smaller than the coherence.
The software evaluates the inteferences and assignes the values of the heights to the accordant pixels. You will receive a image of the heights of the object with a very small error of measurement. The white light interferometer combines the advantages of tactile sensors with the advantages of optical sensors: high measuring accuracy with high data rates.

mvBlueFOX as optical component

3D-Shape uses MATRIX VISION's industrial USB 2.0 camera mvBlueFOX as the camera for the µKORAD^{3D}. Beside the good price-performance-ration, the qualtity and the specification of camera satisfied the decider. The whole camera series of MATRIX VISION have a similar control as the solution of 3D-Shape, the integration has proved to be easy and the promise that the camera will be available for long time, makes a contribution to the decision for the camera.

Application areas of the white light interferometer

The are many possible applications for the white light interferometer. Both for sample surveys and for 100% quality checks the measurement system is suited for. For the interpretation, however, an area is available in contrast to the tactile pendants, which only shows a profile line as a result. During quality checks of the surface of an electronical component for example, the white light interferometer inspects the object and names diameter and height using the resulting measurement data (Figure 2). A further application is the roughness

Figure 5: White light interferometer µKORAD (3D-Shape GmbH)

measurement of milling grooves on metal surfaces along profile lines. Additionally the laminar roughness parameters can be calculated, too (Figure 3).

Conclusion

On all types of measurements, optical systems establish oneself. Here two reasons are decisive: on the one hand the optical measurement substantially are faster than tactile systems, on the other hand the image processing industry uses more and more standard interfaces like USB 2.0. The latter fascinates by easy handling, fast intergration in existent projects and prevalence on customer's side.

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