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Developments in the Field of Asphere and Freeform Measurement

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The significance of aspheres and freeforms is increasing for modern optical systems. Especially for the production of complex optics, metrology is crucial not only for quality assurance, but to enable the production process itself and as a feedback for the optical design. Therefore the capabilities of the measurement equipment has to progress together with the capabilities of the manufacturing process. Mahr aims to provide measurement equipment which is specially tailored to the specific production steps and customer needs such as a MarForm LD Aspheric and MarForm MFU 200 Aspheric as highly flexible point scanning measurement machines, and the area-measuring Tilted Wave Interferometer MarOpto TWI 60 with its unique measurement principle.

The Tilted Wave Interferometer MarOpto TWI 60 is based on non-null interferometric principle in order to directly measure aspheres. In contrast to common interferometric measurement of aspheres, the outstanding TWI principle does not need a cost-intensive computer generated hologram (CGH) or stitching. Thus, the measurement time is optimized and a maximum of flexibility is given. Additionally, even the interferometric measurement of optics produced in low numbers becomes economical.

By optimizing mathematics algorithms the capabilities of MarOpto TWI 60 will be enhanced further in order to measure complex optical surfaces with highest measurement precision. The adoption of the algorithms to enable free form measurement will be one of the next steps in the development of the Tilted Wave Interferometer. The talk will show the principle and the latest enhancements of the MarOpto TWI 60 and give an outlook to the adoption to free form measurement.

Highest flexibility for measuring optical elements or molds with multiple functional interfaces is given by the optical probe sensor of the MFU 200 aspheric in combination with the option of combination with a referenced conventional tactile measurement. Current limitations in surface slope will be overcome by improvement of the acceptance angle of the high-numerical-aperture (HNA) probe and multiple angle measurement. The measurement precision of the machine is improved by the implementation of an athermal compensation and calibration frame to enhance the measurement volume for 3D measurement.

Mainly software adoptions will enable the measurement of freeform optics with fiducials or integrated, monolithic optics consisting of optical surfaces on multiple, molds with optical surfaces and kinematic guidance faces.

Mahr is strongly focused to develop measuring equipment based on future demand of the optical industry.

SHORT BIO:

Andreas Lange is head of R&D at Mahr GmbH in Göttingen with locations also in Jena and Tucson/AZ. USA. He studied electrical engineering at the University of Braunschweig/Germany and joined Voith AG in 1990. He worked in the field of electric vehicles and hybrids for more than 20 years with special focus on field theory problems, new control algorithms and high power density electrical storage devices. He joined Mahr in 2012. Mahr GmbH is a leading supplier of metrology for the automotive and optical industry and is also providing ultra high precision instruments to support the PTB in their strive to redefine units like units like Kilogramm and Meter and constants like Avogardo and Boltzman.

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