



Fig.: CAD model of the set-up

Advantages

- large measurement range
- high evaluation accuracy
- inexpensive components

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Optical position and angle measuring device based on multi-beam interference

A new method for highly accurate and simultaneous measurements of angular changes (pitch, yaw and roll angles) has been developed. It is easy to integrate into measurement processes. A light source that generates an interference pattern is placed on an object whose movement is to be measured. The interference pattern is analysed and evaluated with the help of two image sensors. Through the evaluation, the position and especially the angular position of the object can be determined with high accuracy.

The currently established methods for highly accurate and simultaneous measurement of position and angle changes of an object cannot be used over a sufficiently large angular range with high accuracy. This limitation clearly shows when it comes to measuring large free-form surfaces, such as mirror segments for astronomical telescopes or mirrors for EUV lithography. PTB's new procedure represents an alternative method to the previously used technique for high-precision angle measurement. The set-up consists of a light source that is mounted on the moving object and a detector that detects the emitted light by means of two image sensors. A frequency-stabilised HeNe laser serves as light source. By means of the light, an interference pattern is generated. This can be done in various ways. The detection unit captures the interference pattern calculating the position and angles of the beams of the interference pattern. This information is used to determine the position and angle of the light source. The angular measuring range is only limited by the aperture angle of the light source. The detector arm for angle measurement corresponds to an autocollimator and can determine the angle of many beams of the light source simultaneously. When a beam leaves the measuring range, a new beam enters the measuring range, expanding it as desired.

Economic impact

The combination of imaging system and autocollimator for measuring angle and position offers new possibilities in the field of shape measurement, deflectometry, positioning systems, and projection of the pattern as angular reference.

Development status

A German patent application has been submitted for the invention. Licences for use are available.