Robust One-shot Short Coherence Interferometry ROSI

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Technologie-Lizenz-Büro
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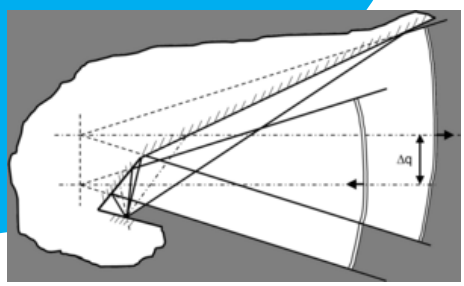
The 'robust one-shot interferometry' (ROSI) has been optimized in several aspects and now offers a miniaturized, robust and long-term stable as well as high-precision point and line profile measurement at very high measurement and evaluation speeds.

- Very high measuring and evaluation speed
- Long-term stability, fast & highly accurate point and line profile measurement, the latter in perspective
- Inexpensive, compact and very robust design
- Evaluation of the phase information provides resolution in the nm range for profile measurement



Application

Researchers at the Institute for Technical Optics, University of Stuttgart, succeeded in developing a sensor design and method for extremely robust one-shot interferometry ('ROSI'), which is currently being further optimized. It is now possible to achieve higher measurement speeds, while ensuring a high level of robustness. As a result, the ROSI approach now offers a decisive advantage, especially for demanding applications such as inline inspection under production conditions.

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16/080TLB
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US 11,231,269 B2 granted

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Background

Optical metrology allows for contactless and non-destructive analysis of an object's metric and spectral properties, covering a broad range of sizes. For example, intensity, contrast, polarization or wavelength can be measured at as many points of an object as required. However, in order to be able to reliably determine the actual target size, a robust and powerful system is needed in addition to efficient algorithms.

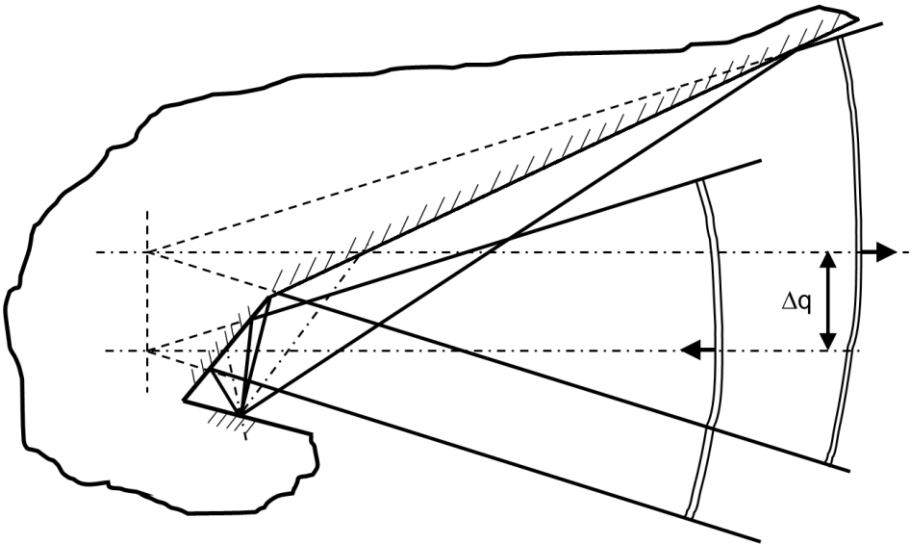
Problem

Interferometry has become an established optical profile measurement method. Chromatic-confocal spectral interferometry (CCSI), for example, provides a very good basis for single-shot applications by combining interferometry with confocal microscopy. However, this approach requires a spectrometer and sophisticated data evaluation, which, in turn, can have a limiting effect on the measurement speed.

Solution

Compared to CCSI, 'ROSI' allows for the generation of robust one-shot data sets in the form of spatial interferograms. For this purpose, it uses a two-beam interferometer with special components, such as a novel three-plane mirror reference end reflector, which can be produced by ultra-precision diamond machining. The well-known and well proven algorithms of white light interferometry can be used for data evaluation. Precise high-resolution profile data can thus be captured at high speed down to the nanometer range using phase information.

The system has been extended by a new application of retroreflection. Thanks to the 'interferometric gain', it enables users to measure less cooperative or non-cooperative surfaces at the lowest level of reflection. In addition, absolute measurement of a 3D object space would be possible by combining the system with 3D coordinate measuring technology.



Miniaturized three-plane mirror reference end reflector (monolith) in the arm of a Michelson interferometer for the generation of an invariant lateral shear Δq needed to obtain spatial interferograms in the Fourier plane of downstream optics [Univ. of Stuttgart].

Publictions and links

https://iopscience.iop.org/article/10.1088/1361-6501/aa52f1