COMPENSATION OF THE REFRACTION INDEX FLUCTUATIONS

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Nanometrology deals with dimensional measurements of micro- and nanostructures with a high spatial resolution. It typically combines a microscope imaging with a precise coordinate measurement, usually capable of nanometer or sub-nanometer resolution laser interferometry techniques. The development in this field is driven, among other things, by emerging advanced nanotechnologies that require the capability not only to see, but also to measure the nanostructures. This pushes the interferometric techniques to their limits. The key source of uncertainty when the measurement is performed on air – the fluctuating refractive index of air (RIA) has to be addressed with a more sophisticated approach than through indirect evaluation by measurement of the parameters of atmosphere.

We propose a technique tackling the problem of fast varying value of RIA. Optical arrangement, based on a setup of several Michelson interferometers, represents a combination of an interferometer and a refractometer into a single system. This setup was used to study the behavior of the ambient airflow with respect to the optical path difference and physical separation of the interferometer's and refractometer's path. Based on the experimental results we proposed new arrangements for displacement measuring interferometers (figure 1), that combine length interferometry and a tracking refractometer for the direct compensation of RIA fluctuations with geometrically close, adjacent optical beams.

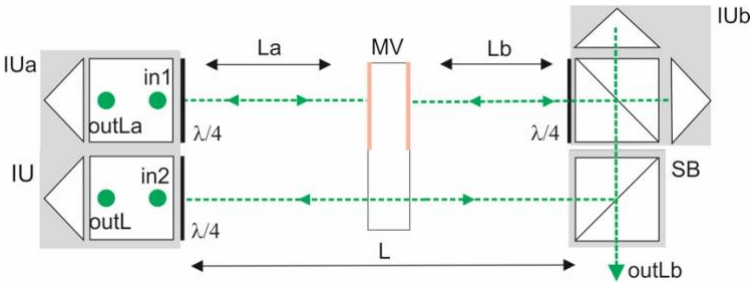

Figure 1.: Schematics of the interferometer arrangement for compensation of the refractive index fluctuations. IU, IU_a, IU_b: Interferometer unit; M: Mirror; SB: Special Beamsplitter Cube; λ/4: Quarter-Wave Plates; In1, In2: Input; OutL, OutLa, OutLb: Output; L, La, Lb: Measured Displacements.