Nanooptics and nanophotonics

Optical-fiber interferometer for measuring nano-displacements in a wide range

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Progress in nanotechnologies makes demands on precision displacement measurement of units of machines and devices. This requires the development of advanced methods and tools for high-precision measurements which are based on laser interferometry. Note that up-to-date facilities projected for experiments to search and detection of gravitational waves must provide displacement measurement of the order of 1.5×10^{-15} cm [1].

We propose optical-fiber interferometer (Michelson's scheme) for measuring nano-displacements in the range from hundreds to sub nanometers. This type of interferometers has a number of advantages [2]: simplified mechanical design, absolute measurement with the natural scale – the laser wavelength, the absence of electromagnetic and thermal noise.

The optical-fiber interferometer consist of the diode laser (650nm, 2.5mW) single-mode fiber (3m, NA-0.12, MFD-4mkm), photodetector and electronic components for signal conversion and improving signal to noise ratio. It can be applied to objects without any special surface treatment (scattering metal surfaces). It was ascertained that interferometer can detect the signal at a distance of up to 800 mkm between fiber end and the mirror (90% coefficient of reflection). Using collimation optics this distance can be increased to 2.5 cm, but it requires a fairly careful adjustment.

1. *Rana X. Adhikari* Gravitational radiation detection with laser interferometry // Review of Modern Phisics .-2014.- **61.-**P. 121-151.
2. *Zumberge M., Berger J* Experiments with an optical seismometer // AGU Fall Meeting Abstracts.-2003.- **84**.-P. C144