IR SENSING BY FIBER-OPTIC SPECKLE BASED INTERFEROMETER

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Speckle-based interferometric methods have been extensively used for industrial applications in measurement of deformation and displacement, object shape, vibrations, etc. Electronic speckle interferometry combined with PC processing technique offers powerful tools for registration of physical quantities and industrial control. In the previous papers [1,2] we presented a speckle-based fiber optic method for registration of low intensity infrared radiation, which is based on the interference of propagation modes in the far field of a multimode fiber. In this report we present new results on the method.

The probing light from a coherent light source is injected into the input face of a multimode optical fiber and at the output end of the fiber the modal distribution of the probing light intensity (the speckle image) is registered. When a physical perturbation hits the fiber, the speckle pattern changes. The CCD placed in the far field is used for registration of the variations of the speckle pattern of the multimode fiber for subsequent PC processing. The IR radiation that falls on the lateral surface of the fiber leads to variation of the phase difference between the propagating modes that leads to variation of the speckle pattern in the far-filed of the fiber. Computer processing of the speckle image provides information on the intensity of IR radiation that hits the fiber. The algorithm based on C++ programming language is developed for processing of the speckle image and to form the output signal which is related to the intensity of IR radiation.

The speckle pattern in the far field of the fiber is dependent on the number of excited modes in the fiber. Consequently the sensitivity of the method is dependent of the number of modes that propagate in the fiber. Experimental results as well as computer simulation data are presented. The method can be applied for registration of IR radiation of low intensity. For practical applications the method needs to be further developed to reduce the noise, to extend the dynamic range as well as to improve the linearity of the characteristic.

[1] Culeac, I. Nistor, M. Iovu, and A. Andriesh, Fiber Optic Interferometric Method for Registration of IR Radiation, In the Book: A. Vaseashta et al. (eds.), *NATO Science for Peace and Security Series A: Chemistry and Biology*, DOI 10.1007/978-94-007-2488-4_42,. 2012, p. 379
[2] I.P. Culeac, Iu.H. Nistor, M.S. Iovu, A.M. Andries, *Proceedings of the International Conference* „Romopto 2009”, 29 August 2009 - 4 Septembber 2009, Sibiu, Romania, 2009, Proceedings of the SPIE, Vol. 7569, 74690G (2009), Publication date 17 May 2010.