

1.5.26. HARDWARE AND TECHNOLOGICAL FEATURES OF FIBER-OPTIC PROBES OF DISPLACEMENTS

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When selecting methods and tools for process control and defectoscopy, it is important to form the primary information of the objects. In comparison with the well-known and traditional instruments and systems, optical metrology transducers are different with their dynamic advantages. An important feature of the fiber-optic converters and systems are the interactions and communications capabilities. High sociability and system compatibility of such converters provide a broad perspective of effective use in technical means of non-destructive testing and defectoscopy [1, 2].

When you create a fiber-optic components and systems for process control you can be interested in models and structures of the information transformations and their circuit implementations through elementary optical monofilaments. Along with the noise immunity in the transmission of information, optical monofilaments permit to build a non-contact scheme (without mechanical contact) converters with galvanic separation circuits [3].

The chain of transformations, in which gap plugs the controlled object, is the optical-electronic channel in the form of mutually combined optical and optoelectronic, microprocessor and other functional elements. By this, optical radiation under the influence of object, form the primary information that defines the physical-technical properties and characteristics of the object. The energy of radiation at low wavelengths of optical bandwidth with help of monofilaments concentrates in a given area (volume) of space, which allows transfer of large capacities and localized monitoring of the informative flow, reflected from the object. Radio and television do not have these advantages, as well as acoustic, electromagnetic, radiation, and other systems.

From circuit point of view, fiber-optic converter is a systemic association of individual light isolated fibers, formed in accordance with the desired function and algorithm. Specific physical, optical-mechanical and optical features of monofilaments provide fiber-optic converters significant advantages in implementing the model in process control operations.

For the realization of fiber-optical conversion, large influence has the technological features of the use of monofilaments. Particular influence has bending of individual monofilaments. The report emphasizes the study of the influence of bending of the monofilaments on the results of monitoring, as well as in the presence of large numbers of microbendings, they become the main weaken factor for passing the radiation of a bent optical fiber.

In the optical instrument making, the practical application is found by the class of fiber-optical functional elements, based on tapered optical fiber [6]. Light conductors with variable section are most widely used, when the diameter of light conductor is changed in the course of an optical beam in the form of a truncated cone or other shape. An important feature of such a light conductors, called focon [4], is the ability to increase or decrease luminance or image, N times (to be determined from the expression):

$$N = \tau \left(\frac{D}{d} \right)^2,$$

where τ – is the transmittance of light radiation by the light conductor; D – diameter of the wide end of a light conductor; d – diameter of the narrow end of a light conductor.

This feature of cone light conductor allows you to use a fokon as a focusing element and a large-scale converter of images. Implementation of focal light concentrator to measurement channel makes change of the resolution of an information system, proportional to the multiplicity of focon $V = D / d$.

The report reviews the information features of focons with the transparent and semi-coated optical fiber.

The small size and flexibility make it possible to build a variety of monofilaments light conductor systems in the geometric size and shape. Input and output ends of rigid and flexible cable may have the same round, oval, rectangular, square and other forms of design. In some cases, round or square end of the input corresponds to the outlet end in the form of rings, rulers, some characters, etc.

Constructive variety of technological forms of light conductors expands access of the information converters to zones and areas of objects, limited with location and conditions of use.