Ontology of Addressed Fiber Bragg Structures as a New Type of Sensor Elements

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An ontology of addressable fiber Bragg structures developed at KNRTU-KAI since 2015 is presented. The last version of the four-component structure is presented in more detail.

A four-component addressable fiber Bragg structure (FAFBS) is a quasi-periodic structure formed in the core of an optical fiber, the spectral response of which in the optical range is a four-frequency signal localized in the "narrow" part of the spectrum, the difference frequencies between the components of which are much lower (by five and more orders) of optical carriers and correspond to the radio frequency region of the spectrum. A characteristic feature of FAFBS is the invariance of the indicated difference frequencies when deformation or temperature fields are applied to the structure, which makes it possible to use them as sensitive elements of measuring systems with addressable properties, while the difference frequencies are called addressable. In this case, each FBG structure in the FAFBS structure has a phase pi-shift.

Analytical expressions are obtained that allow one to determine the shift of the central wavelength of the FAFBS. The computer simulation of the use of FAFBS in the problems of measuring the temperature of the windings of power transformers has been carried out. Simulation showed that more accurate temperature measurement results are obtained when the circuit operates in reflection, *i.e.* at an additional address frequency.

With the use of FAFBS, there is no need to install additional frequency filters in 8 situations and one option in all 12 situations compared to the double-component AFBS (DAFBS) option. It is not required to use address component recovery schemes compared to the three-component AFBS (TAFBS) option. This fact is a significant difference between the developed systems based on FAFBS and systems based on DAFBS and TAFBS.