ZERO SHIFT IN FIBER RING INTERFEROMETER WITH WIDEBAND RADIATION SOURCE

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It is shown that the polarization zero shift of a fiber ring interferometer (FRI) is chiefly determined by the Stokes components of the radiation, which are circularly and linearly polarized at an angle of 45° to the axis of the polarizer. A birefringent element between the polarizer and coupler in conjunction with a wideband source results in disappearance of the FRI zero shift, regardless of the mutual orientations of the polarizer, coupler, and birefringent element.

When nonmonochromatic radiation is propagated in a single-mode fiber light guide (SMFG), the radiation is depolarized due to the frequency dependence of the relative phase shifts of the polarization modes of the light guide. In a fiber ring interferometer (FRI), this results in partial averaging of the zero shift caused by anisotropy of the FRI elements.

The possibility in principle of using the depolarization effect for zero-shift averaging has been discussed in the literature [1]. A zero shift of the first order of smallness with respect to the amplitude extinction factor ε is produced by the interference of waves one of which enters and exits the FRI in the allowed direction of the polarizer while the other enters in the forbidden direction and exits in the allowed direction of the polarizer. These waves have different optical paths; therefore, the first-order shift in ε is a function of difference between the phase advances of these waves. When a "depolarizing" light guide is present in the FRI, the difference between the phase advances of the waves will vary with the radiation frequency, and, therefore, it can be averaged with the aid of a wideband source.

The depolarizing properties of a light guide manifest themselves differently depending on where it is located — before the polarizer [2], between the polarizer and the FIR [3], or in the FRI [4] — and how the birefringence axes of the light guide are oriented with respect to the allowed direction of the polarizer. The orientation of the birefringence axes in the FRI changes in an uncontrollable manner — local microbends are caused by random irregularities in the light guide (we shall not examine these here); bends in the light guide as a whole are produced when the elements of the all-fiber interferometer are fabricated.

We shall show that turning of the birefringence axes of a strongly birefringent, just as a single-polarization, SMFG in the FRI results in a zero shift that is not a function of the radiation frequency. It is also shown that turning of the birefringence axes of the light guide between the polarizer and FRI circuit does not lead to a zero shift, but the frequency-dependent phase advance of the polarization modes in this light guide converts the frequency-independent component in the FRI zero shift to a frequency-dependent component. The "depolarizing" properties of the light guide between the polarizer and FRI are not functions of the orientation of its birefringence axes, which simplifies the use of this method for reduction of FRI zero shift.

FRI ZERO SHIFT (GENERAL EXPRESSION)

We shall represent the wave that emerges from the FRI (Fig. 1) as the sum of two waves: **a** and **b**, which pass through the circuit in clockwise and counterclockwise directions, respectively. With passage through the circuit, each of these waves acquires an additional phase advance of $\varphi_c/2$ due to the Sagnac effect. We shall write a formula for the radiation intensity at the FRI exit ignoring the dependence of φ_c on the radiation frequency:

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