Mach-Zehnder modulator based analog signal transmitting system for diagnostics of fast processes

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Fiber-optic links are an alternative to traditional coaxial cable to transmit the single wideband analog signals on powerful physical facilities. Small attenuation, significant bandwidth and low dispersion in single-mode fibers enables to transmit a range of detector waveforms in C-band to a considerable distance while maintaining temporal resolution.

The simplest method to convert electrical signal into the optical domain is a direct modulation: the current flowing through the LED or laser diode modulates the optical intensity. This current is determined by the detector of transient process. The main disadvantage of this method is that the optical source is also a modulator.

Modulation of the current flowing through the diode changes simultaneously several parameters of the optical radiation (intensity, long wave generation, the resonant frequency in the amplitude frequency characteristic, etc.), which greatly limits the characteristics of this signal transmitting method.

For external modulation, the optical source is separated from the modulator, which allows to increase an optical power (and hence dynamic range) without changing the frequency response of transmission lines, to minimize lateral frequency modulation signal (chirp), to increase data capacity (using WDM). Optical source can be also placed in the protected area.

We use Mach-Zehnder intensity electro-optical modulators (MZM) to modulate light [1–3]. To recover the transmitted signal waveform we use the method of determining the optical transfer function and the bias point of MZM directly during the experiment [4]. The results of waveform transmission over at least 1 km and subsequent recovery with high dynamic range are presented.

References

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