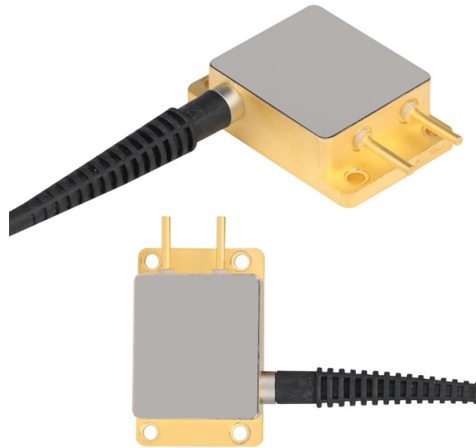


Fiber Optic Communication Based on Digital Signal Processing



Article Overview

Digital Signal Processing (DSP) is a cornerstone technology in modern fiber optic communication, enabling compensation of transmission impairments and enhancing high-capacity, long-distance optical networks.

Overview of DSP in Fiber Optic Communication

Fiber optic communication systems face several impairments that degrade signal quality, including chromatic dispersion (CD), polarization mode dispersion (PMD), laser phase noise, and Kerr nonlinearities. DSP, combined with coherent optical detection, allows the full capture of amplitude and phase information of optical signals, enabling electrical-domain compensation of these impairments. This approach provides flexibility in system design, deployment, and operation, particularly for long-haul, high-capacity networks.

Key DSP Techniques

- **Chromatic Dispersion Compensation:** DSP uses time-domain and frequency-domain equalizers to correct pulse broadening caused by CD. Filters such as finite impulse response (FIR) filters and frequency-domain equalizers (FDEs) are commonly employed, with adaptive algorithms like least-mean-square (LMS) optimizing tap weights for effective compensation.
- **Polarization Mode Dispersion Mitigation:** Adaptive equalization techniques, including the constant modulus algorithm (CMA), are used to correct PMD, ensuring stable signal recovery over long distances

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