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Design and analysis of a dynamic code division multiple access communication system based on tunable optical filter

ABSTRACT

A dynamic optical code division multiple access (DOCDMA) communication system is proposed for high-band-width communication systems. An implementation of the system is proposed based on a fast tunable optical filter (TOF) in each encoder and decoder. This technique actively modulates the central wavelength of a TOF according to a functional code at the transmitter during the bit period before the transmission of the data. The system is modeled and analyzed taking into account multiple access interference (MAI), thermal noise, and phase-induced intensity noise (PIIN). The performance of this system is compared to that of a spectral amplitude coding system that uses either a Hadamard code or a modified quadratic congruence (MQC) code. The results show that the proposed DOCDMA system reduces the PIIN effect on the performance of the system and improves the bit error rate (BER) performance at a large number of users. Furthermore, it is found that when the effective power is large enough, the MAI becomes the main factor that limits system performance, whereas when the effective power is relatively low, both thermal noise and PIIN become the main limiting factors with thermal noise having the main influence. © 2005 IEEE.

Keyword: Multiple access interference; Optical code division multiple access (CDMA); Optical fiber communication systems; Spectral amplitude coding