

## Design and Performance Improvement of Three-Dimensional Optical Code Division Multiple Access Networks with NAND Detection Technique

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**Abstract :** In this paper, we have presented and analyzed three-dimensional (3-D) matrices of wavelength/time/space code for optical code division multiple access (OCDMA) networks with NAND subtraction detection technique. The 3-D codes are constructed by integrating a two-dimensional modified quadratic congruence (MQC) code with one-dimensional modified prime (MP) code. The respective encoders and decoders were designed using fiber Bragg gratings and optical delay lines to minimize the bit error rate (BER). The performance analysis of the 3D-OCDMA system is based on measurement of signal to noise ratio (SNR), BER and eye diagram for a different number of simultaneous users. Also, in the analysis, various types of noises and multiple access interference (MAI) effects were considered. The results obtained with NAND detection technique were compared with those obtained with OR and AND subtraction techniques. The comparison results proved that the NAND detection technique with 3-D MQC\MP code can accommodate more number of simultaneous users for longer distances of fiber with minimum BER as compared to OR and AND subtraction techniques. The received optical power is also measured at various levels of BER to analyze the effect of attenuation.

**Keywords :** Cross Correlation (CC), Three dimensional Optical Code Division Multiple Access (3-D OCDMA), Spectral Amplitude Coding Optical Code Division Multiple Access (SAC-OCDMA), Multiple Access Interference (MAI), Phase Induced Intensity Noise (PIIN), Three Dimensional Modified Quadratic Congruence/Modified Prime (3-D MQC/MP) code

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