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Rapid-Convergence Minimum Mean Square Error Equalization in Few Mode Fiber

Abstract

Mode coupling is the main bandwidth limitation in mode division multiplexing (MDM) systems. A conventional adaptive algorithm for equalization in MDM is the least mean square (LMS), which has a slow convergence rate. In this work, an adaptive minimum mean square error (MMSE) algorithm is modified for improving the convergence rate for equalization in MDM. The MMSE is based on zero-forcing equalizer (ZFE), redistributing the power coupling coefficients of the received transverse field so that the power is coupled back into the same mode as that at the transmitter. This alleviates inter-symbol interference (ISI). The MMSE-based feedforward equalization (FFE) and decision feedback equalization (DFE) MDM is numerically simulated for 1, 2, 3 and 4 channels. Each channel transmits 10 Gbps for a distance of 1300 meters, carried by a distinct linearly polarized mode, through a few mode fiber (FMF), at a wavelength of 1530 nm. The enhanced MMSE equalization scheme showed improvements in the bit error rate (BER), power coupling matrix, eye diagram and convergence rate.