

RSoft ModeSYS and OptSim

Modeling of PAM-4 Transmission Over Large-Core Plastic Optical Fiber Using the DSP Library for MATLAB

Due to its relaxed alignment tolerances and low cost, step-index (SI) plastic optical fiber (POF) is an attractive technology for short-distance data interconnects. Furthermore, PAM-4 modulation with digital signal processing (DSP) equalization at the receiver can help overcome the inherent bandwidth limitations of POF at Gb/s data rates.

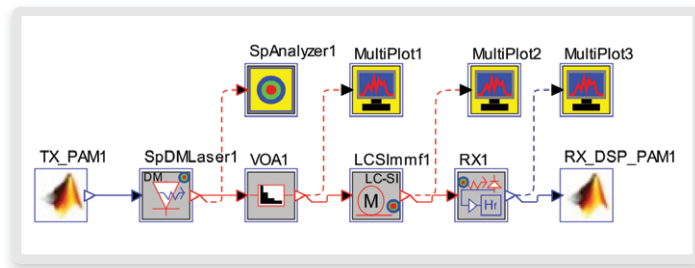


Figure 1. Schematic of PAM-4 transmission over SI-POF

Figure 1 illustrates a Synopsys RSoft ModeSYS™ topology that implements end-to-end 1-Gb/s PAM-4 transmission over 1-mm diameter SI-POF. ModeSYS simulates the fiber using a computationally efficient model based on the Gloge power-flow equation, while MATLAB® co-simulation models the transmitter and receiver DSP using a mix of functions from the RSoft OptSim™ DSP Library for MATLAB and custom routines. The transmitter generates an electrical PAM-4 signal with Nyquist pulse shaping and pre-emphasis filtering, and the receiver DSP uses an LMS equalization algorithm to recover the transmitted symbols and analytically estimate the BER.

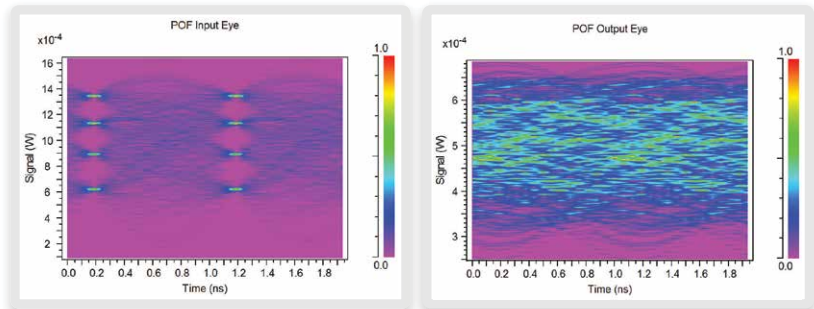


Figure 2. POF input (left) and output (right) eyes, showing the effects of intermodal dispersion and mode coupling

Figure 2 depicts the optical eyes at the POF input and output, showing eye closure due to intermodal dispersion and mode coupling. Figure 3 illustrates the recovered eye diagram after the receiver's analog-to-digital conversion and equalization, which has compensated for the eye closure.

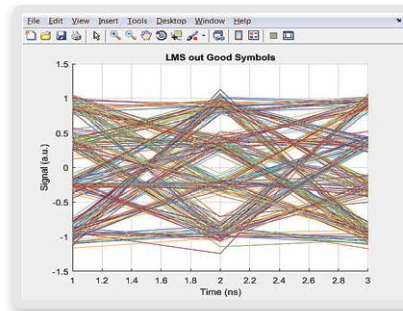


Figure 3. Equalized eye at the receiver demonstrating compensation of the eye closure