

# RSoft Application: Multilevel Intensity Modulated Automotive Optical Interconnects

## PAM-4 Transmission Over Large-Core Plastic Optical Fiber

### Overview

An automotive manufacturer in Asia needed a spectrally efficient optical interconnect design for automotive data transmission at Gbps data rates.

### The Challenge

Large-core, Plastic Optical Fiber (POF) is cost effective for simplex and duplex automotive data links, but conventional simulation-assisted prototyping is computationally expensive. Transmitters and receivers for multi-level modulated data are complex. Furthermore, POF has inherent bandwidth limitations, hindering transmission of high-speed data. The RSoft™ ModeSYS™ and OptSim™ tools can handle this design challenge.

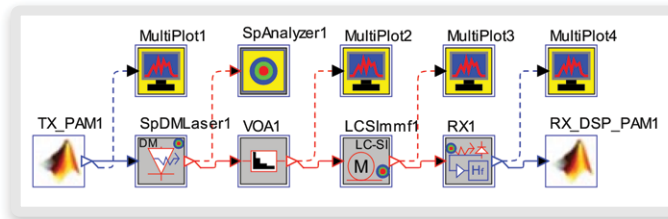


Figure 1. OptSim topology for simulating PAM-4 transmission over POF

### The Solution

ModeSYS can simulate large-core POF using PAM-4 modulation, which provides an excellent trade-off between spectral efficiency and complexity of receivers and transmitters compared to coherent transmission systems. OptSim can then model the transmitter and receiver digital signal processing (DSP) using MATLAB functions from the OptSim DSP library and estimate the bit error rate (BER).

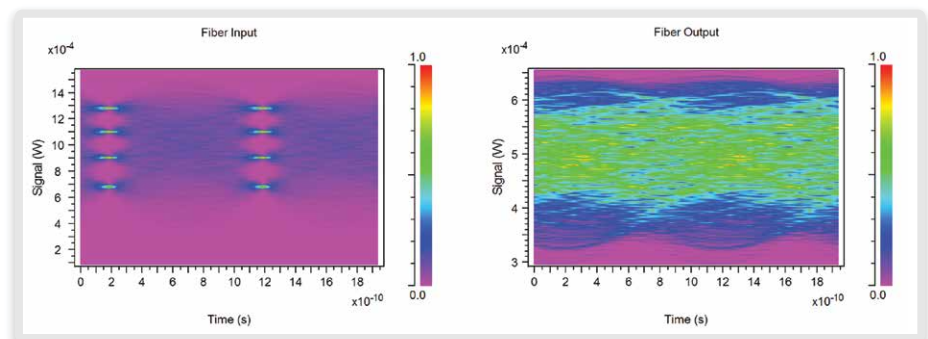


Figure 2. ModeSYS simulation of POF input (left) and output (right) eyes, showing the effects of intermodal dispersion and mode coupling

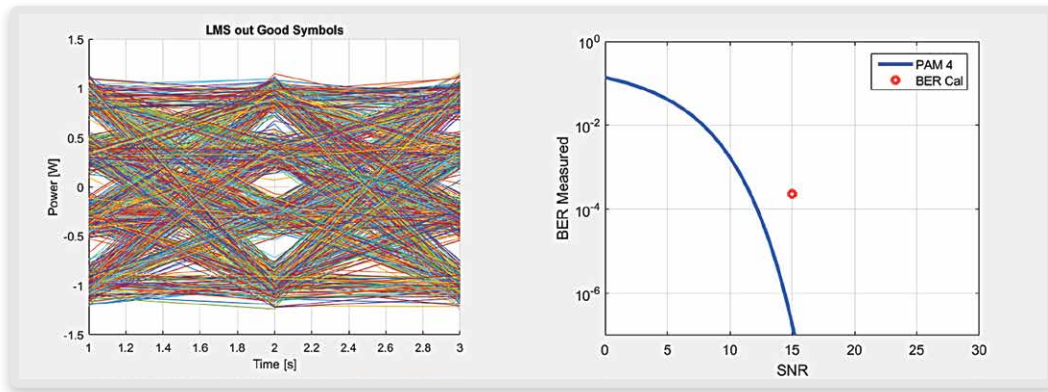


Figure 3. OptSim output showing: equalized eye at the receiver demonstrating compensation of eye closure (left); analytical BER estimate in comparison to ideal reference curve (right)

## The Result

- ▶ Intermodal dispersion affects the transmission of data (Figure 1); data rate is 1 Gbps
- ▶ DSP-based equalization helps recover transmitted data (Figure 2)
- ▶ The BER is  $10^{-4}$ , which is lower than the commonly used pre-forward error correction (pre-FEC) threshold of  $10^{-3}$  (Figure 3)

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