

RSoft Application: Predicting Effective Modal Bandwidth of Multimode Fibers

Empirical Method Vs. Rigorous Index-Based Method in ModeSYS

Overview

A US-based Ethernet transceiver designer for Ethernet links needed an accurate method of predicting effective modal bandwidth (EMB).

The Challenge

For high-speed applications, multimode fiber's refractive index profile is a poor predictor of fiber behavior. Differential mode delay (DMD) profiles can be measured accurately, but their use in bandwidth prediction is empirical and often debated in industry literature.

The Solution

RSoft™ ModeSYS™ provides rigorous simulation-assisted method for predicting EMB. The method involves coupling an arbitrary input source to index-based multimode fiber model and measuring frequency response of simulated output. The refractive index can be arbitrary, including manufacturing imperfections.

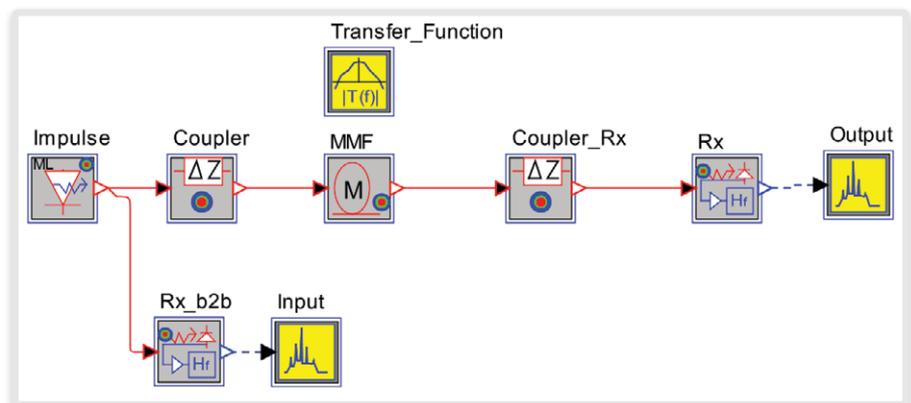


Figure 1. ModeSYS layout for measurement of EMB of a multimode fiber

The Result

The plot in Figure 2 compares empirical DMD-based EMB calculation with the one given by index-based, rigorous simulation from ModeSYS. For the fiber under test¹, the empirical method underestimated the EMB by approximately 2.7% (4.40GHz from ModeSYS simulations vs. 4.28GHz from DMD-based method).

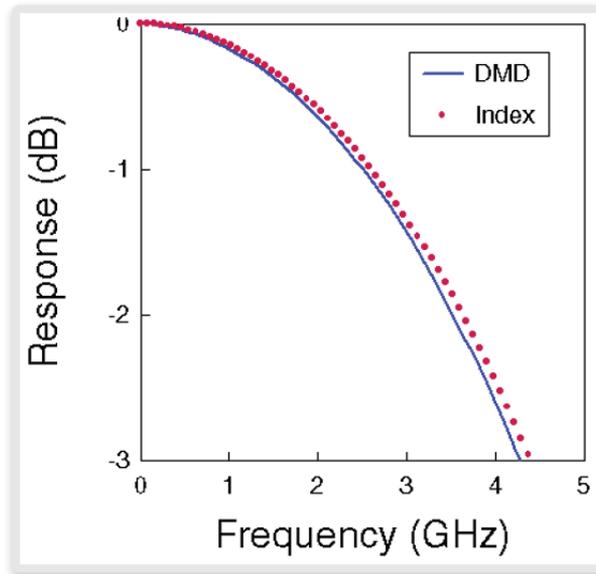


Figure 2. Comparison between empirical DMD-based EMB estimation (solid blue line) and rigorous index-based simulation (dotted red line)

¹J. Morikuni, P. Mena, B. K. Whitlock, and R. Scarmozzino, "Simulation-based prediction of multimode fiber bandwidth for 10 Gb/s systems," IEEE LEOS Annual Meeting Conference Proceedings, paper WEE1, pp. 604-605, 2002.

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