

# 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.

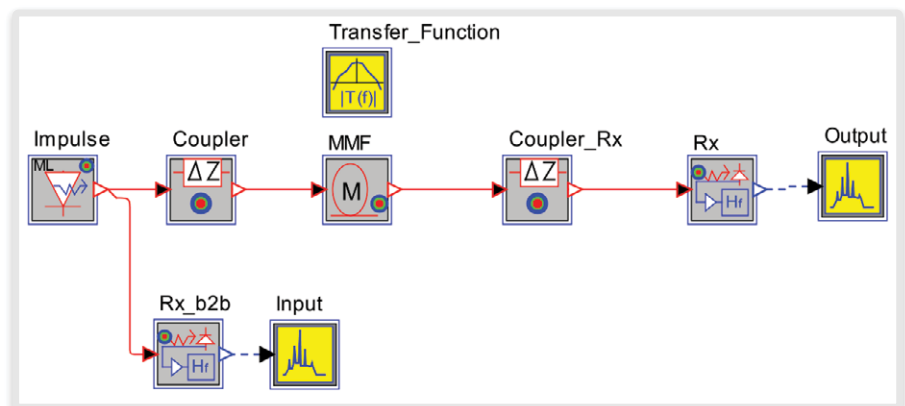


Figure 1. ModeSYS layout for measurement of EMB of a multimode fiber

## 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 test<sup>1</sup>, the empirical method underestimated the EMB by approximately 2.7% (4.40GHz from ModeSYS simulations vs. 4.28GHz from DMD-based method).

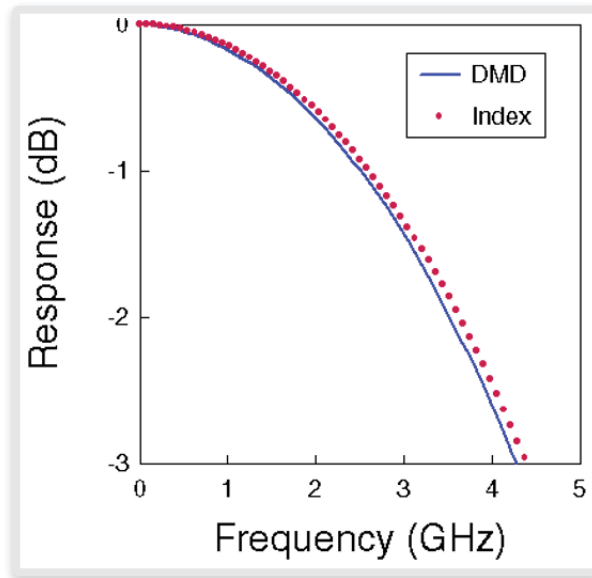


Figure 2. Comparison between empirical DMD-based EMB estimation (solid blue line) and rigorous index-based simulation (dotted red line)

<sup>1</sup>J. 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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