RSoft Application Gallery:
Performance of Silicon Photonic Ring Modulator-based Transceivers in Coherent Fiber Optic Systems

Tools Used: OptSim Circuit and OptSim

This OptSim Circuit application case study illustrates simulation of a silicon photonic PIC and analysis of its performance at the system level[1]. Performance analysis for the PIC is carried out for 32- and 16-GBaud polarization multiplexed quadrature phase shift keying (PM-QPSK). Comparison is made in terms of optical-signal-to-noise-ratio (OSNR) penalty for transceivers based on lithium niobate ($LiNbO_3$) and silicon photonic (SiP) microring modulators.

Figure 1 shows the OptSim Circuit transceiver topology. Figure 2 shows a schematic of the transmitter PIC. Figure 3 shows the PIC performance in terms of OSNR penalty for 32 GBaud (left) and 16 GBaud (right) cases. The black curve shows the theoretical limit, the blue curve corresponds to the $LiNbO_3$ Mach-Zehnder Modulator (MZM) case, and the magenta curve denotes the silicon microring modulator case. The simulation shows that the ring modulator setup can operate up to a gross symbol rate of 32 GBaud with an OSNR penalty at BER=10^{-3} with respect to the MZM of 4.2 dB. The penalty decreases with the symbol rate, and is reduced to 1.3 dB at 16 GBaud. The simulation also shows high thermal sensitivity of the ring modulator suggesting the need for accurate temperature control.

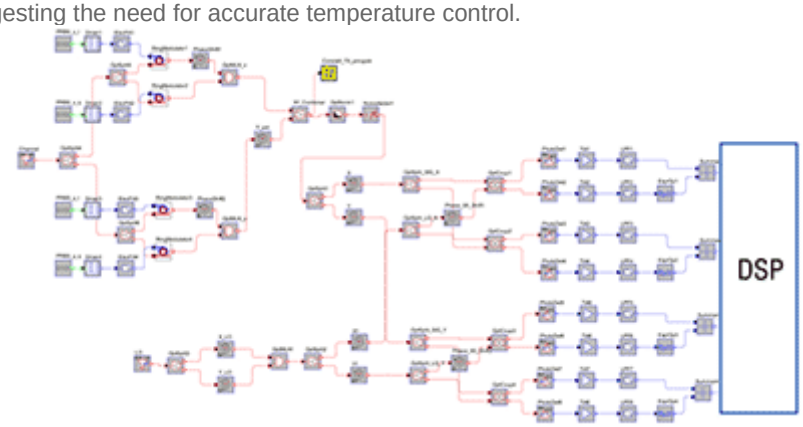

Figure 1: OptSim Circuit transceiver topology

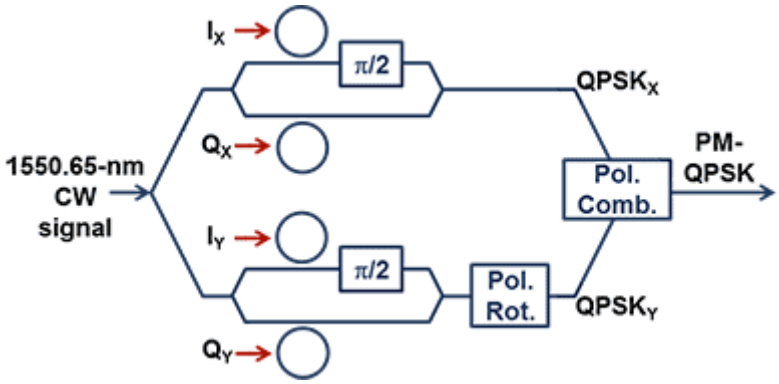

Figure 2: Schematic of the transmitter PIC

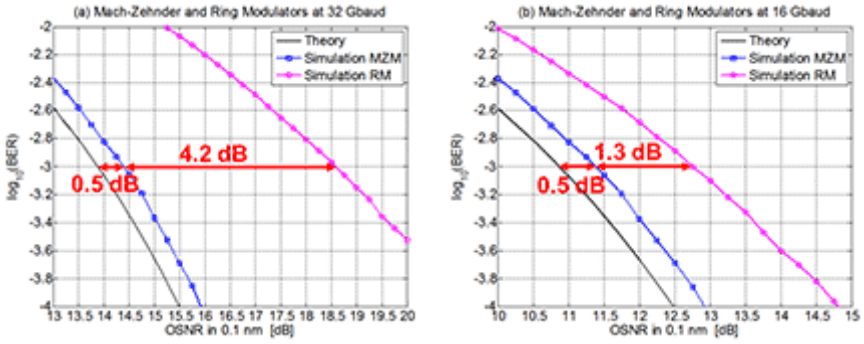

Figure 3: PIC performance in terms of OSNR penalty for 32 GBaud (left) and 16 GBaud (right) cases

References:

[1] E. Ghillino, P. Mena, V. Curri, A. Carena, J. Patel, D. Richards and R. Scarmozzino, "Simulation of Silicon Photonic Coherent PM-QPSK Transceivers Using Microring Modulators," 16th International Conference on Transparent Optical Networks (ICTON), July 6-10, 2014, Graz, Austria.