## 3. Simulation Circuit of Optical EXOR Gate Without Additional Input Beam

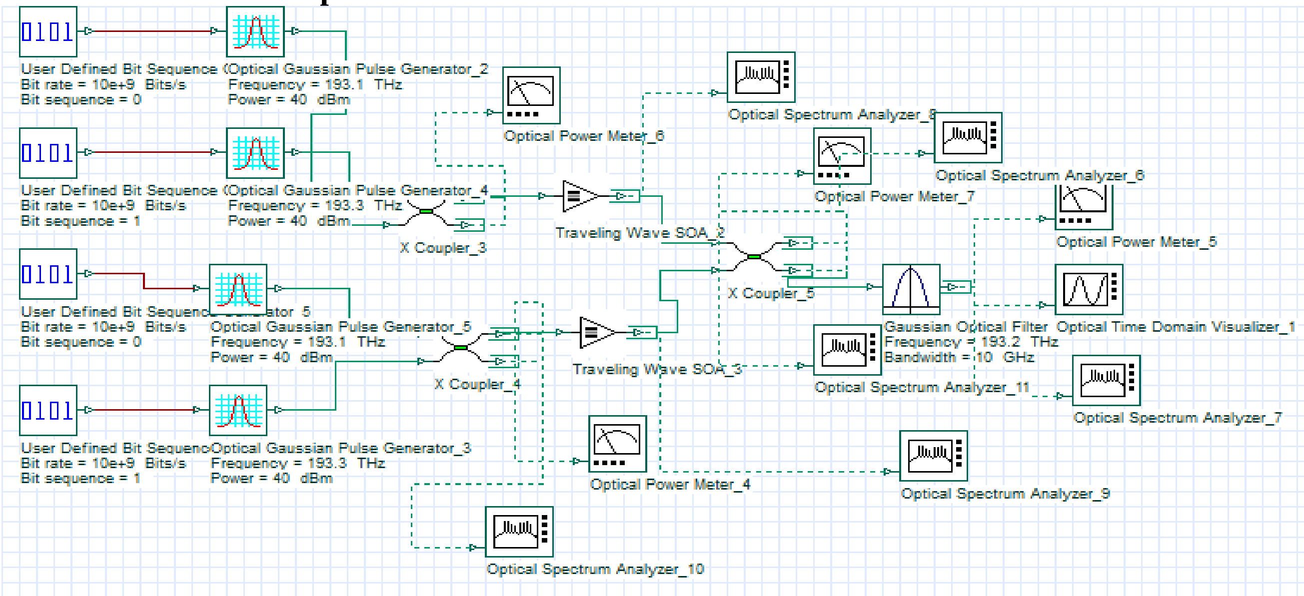


**Figure 2:** Circuit of optical EXOR gate without additional input beam designed on Opt wave Software

## 4. Design of EXOR Gate Without Additional Input Beam

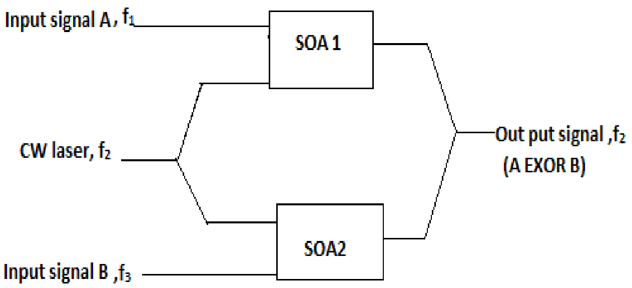


**Figure 3:** Configuration of all-optical XOR gate with additional input beam.[4]

This design is using phase to amplitude modulation in semiconductor optical amplifier co propagating Mach-Zehnder interferometer (SOA-MZI) configuration. In this XOR gate, CW laser beam is used as additional input beam. A works on all optical combinational circuits based on SOA in filter configuration are reported in research papers [6,8] . SOA-MZI configuration [9] is superior to optimize the performance of all-optical logic gates. Therefore SOA-MZI configuration is used for the design of all-optical XOR gate used in the proposed all-optical encoders.

So, the output of XOR gate is calculated by equation given below:

$G_n = A_n \oplus B_n$, where n = 0, 1, 2…

## 5. Simulation Circuit of Optical EXOR Gate with Additional Input Beam

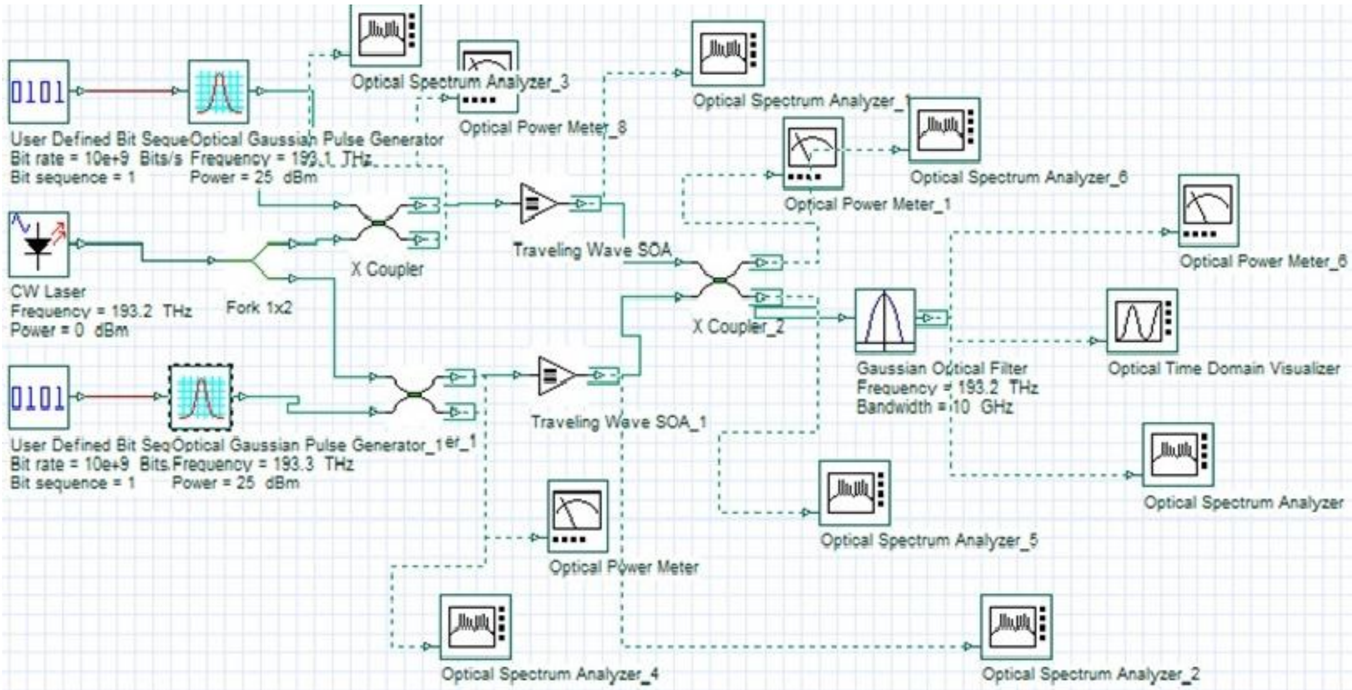


**Figure 4:** Circuit of optical EXOR gate with additional input beam designed on Optiwave Software

## 6. Simulation Result of Optical EXOR Gate

Boolean expression: AB + AB = A XOR B

**Table 1:** Truth Table of optical EXOR gate

| A | B | XOR |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

## 7. Comparison Between both Optical XOR Gate with and Without Additional Input Beam

"All-optical XOR gate using semiconductor optical amplifiers without additional input beam," presented by J. H. Kim, Y. M. Jhon, Y. T. Byun, S. Lee, D. H.Woo, and S. H. Kim [4], proposed design of an all-optical XOR gate by using cross-gain modulation of semiconductor optical amplifiers has been suggested and demonstrated successfully at 10 Gb/s**.** No additional input beam such as a clock signal or continuous wave light is used in this design, The extinction ratio of this XOR gate was measured to be 11db.

While in the design of "All-optical XOR gate using semiconductor optical amplifiers with additional input beam" using phase to amplitude modulation in semiconductor optical amplifier co propagating Mach-Zehnder interferometer (SOA-MZI) configuration. **.** Additional input beam such as a clock signal or continuous wave light is used in this design. The extinction ratio of this XOR gate was measured to be 39.127 db.

## 8. Conclusion

So, optical XOR gate using semiconductor optical amplifiers with additional input beam has better extinction ratio than optical XOR gate without additional input beam. XOR gate with additional input beam provides extinction ratio of 39.127 db which is a better extinction ratio so as to differentiate easily between low and high logic levels in terms of power. The MZI co-propogating configuration used in XOR gate with CW laser beam is superior than other designs reported earlier as it provide high operating speed and good extinction ratio. This paper will provide the better optical XOR gate on the basis of extinction ratio. On the basis of this criteria , different logic circuits such as Pseudorandom sequence generator, scrambling, encoders etc can be designed in all-optical domain.

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