

# Comparative Analysis of AM and MZ Modulator in $2 \times 100$ Gbps Based WDM Optical Network

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**Abstract:** Multiplexing is widely employed due to its capability to increase transmission capacity and to reduce system costs. The system features multiplexing of the basebands in electrical domain as well as multiplexing in optical domain (WDM). The design is proposed for 10- users, each one assigned a different RZ duty cycle and with a data rate of 20 Gbps. In this work, optical wavelength Division Multiplexing is done on wavelengths 1550nm and 1552nm. There are two modulation schemes AM and MZ are compared for  $2 \times 100$  Gbps Based WDM Optical Network. The AM shows better performance as compared to MZ modulation scheme, AM transmitted successfully upto 78km where as MZ up to 75km.

**Keywords:** WDM, BER, AM, Mach-Zehnder

## I. INTRODUCTION

Multiplexing is one of the fundamental necessities in today's digital communications. Multiplexing allows multiple users (or data inputs) to share the bandwidth of the transmission medium. In existing systems, the medium is normally shared based on time slot (TDM), carrier frequency (FDM) or spectrum coding (CDM). The goals of all multiplexing techniques are to support as many users as at high speed and at the lowest cost possible [3].

The process of mixing the information to an optical and electrical signal is called modulation and in this process use to a device to modulate the information is called modulators. The more important kinds of modulators in optical communication are Mach-Zehnder (MZ) modulator, Amplitude Modulator (AM), Phase Modulator (PM), Frequency Modulator (FM) and Electro absorption Modulator[4]. The basic diagram of modulator is shown in figure.1

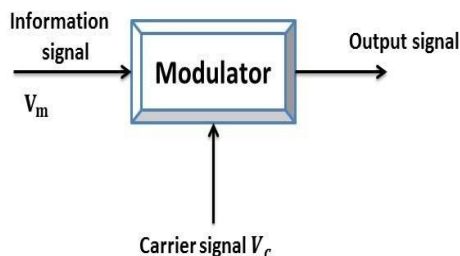


Figure.1 Concept of Modulator

In optical fibre communication the number of optical modulators requirements by used in large capacity photonic networks. Radio over Fibre (RoF) systems to produce millimeter-waves by using the external electro-optic modulator is named Mach-Zehnder modulator.

In wavelength division Multiplexing (WDM) system the Mach-Zehnder (MZ) modulator plays an important role and a single modulator are used to modulate several immobile wavelengths or single variable wavelength[1]. Both of low frequency and high frequency Components are collected by Amplitude Modulated signal.

The low Frequency signals are generate the envelope of the modulating signal. The Acoustic signal is baptized low frequency signal and the AM radio station would be the transmitting the high frequency signal. In phase modulation the carriers phase variation allowing to the message signal.

If carrier frequency is modification allowing to the message signal that is termed FM and the bandwidth of AM is a smaller amount as associate to bandwidth of FM. In FM system the signal's information bandwidth is less than the signal's transmission bandwidth.

Due to the presence of an electric field the transformation of the optical absorption Coefficient in materials represents by the electro absorption (EA) consequence. The materials of EAMs are working the optical wavelengths at 1.3 to 1.6  $\mu\text{m}$ .

## II. SIMULATION SETUP

Figure.2 shows simulation setup of 10-user WDM Optical Network, the signals are generated by Return-to-zero pulse generators with different duty cycle and electrically multiplexed by adders.

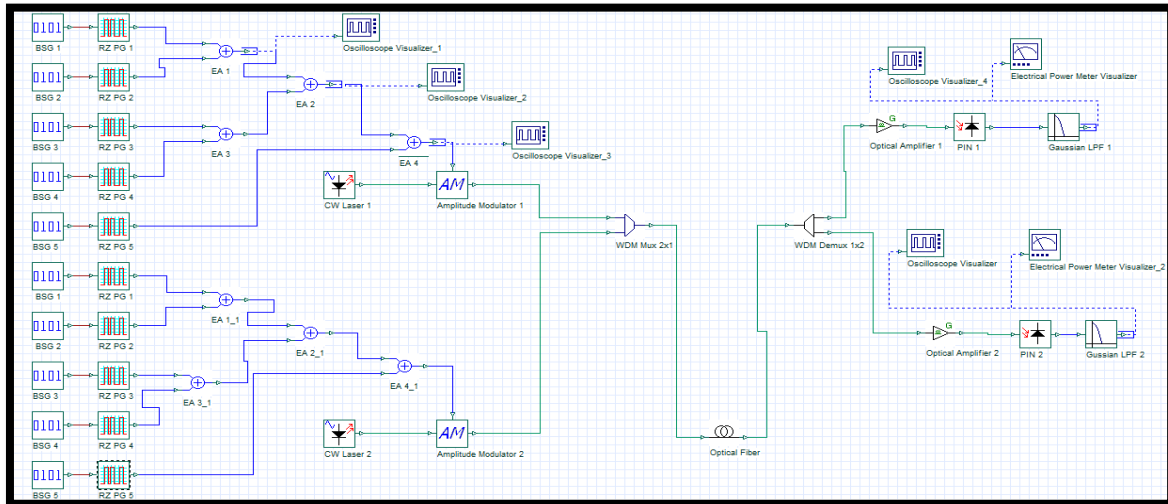


Figure.2 Simulation setup for 2x100 Gbps WDM Optical Network

### III. RESULTS

Fig.3 shows BER comparison of AM and MZ Modulator for 2x100 Gbps Based WDM Optical Network. The AM shows better performance as compared to MZ modulation scheme, AM transmitted successfully up to 78km where as MZ up to 75km.

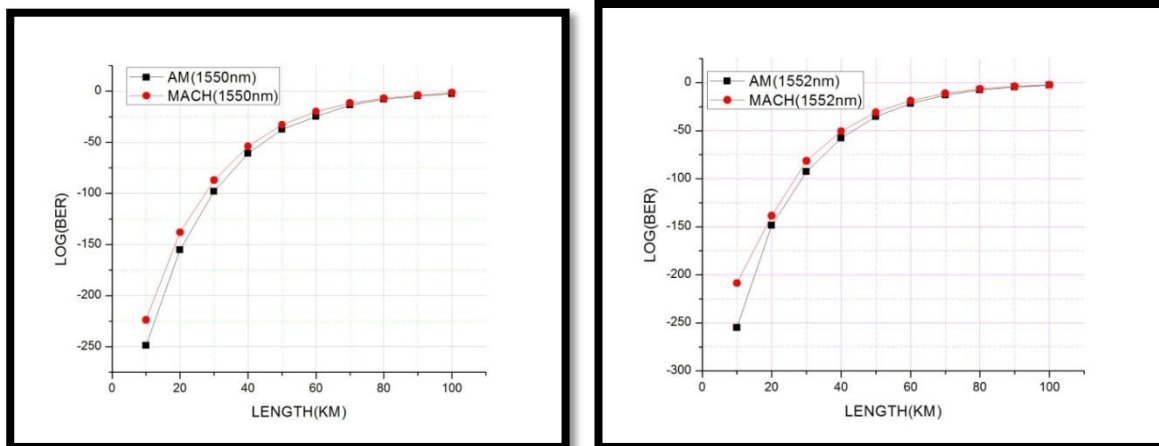


Figure.3 Log BER Vs Length for AM and MZ modulators

### IV. CONCLUSION

The 2x100 Gbps Based WDM Optical Network is successfully designed. A technique of AM shows better performance as compared to MZ modulation scheme and AM transmitted successfully upto 78km where as MZ up to 75km using SSMF.

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