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A Review on Optimization of Bit Error Rate and Q-factor in Fiber Optic Communication using Dense WDM

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***Abstract* - This review work based on the Performance exploration of the bit error rate (BER) and Q-factor. BER is the measurement of bits that have errors relative to the total number of bits received in a transmission. There are so many different types of modulation techniques scheme is recommended for improvement of BER and Q-factor in fibre optic communications. The advanced scheme has been tested on optical fibre systems using Dense Wave Length Division Multiplexing (DWDM) operating with a non-return-to-zero (NRZ) format at transmission rates of up to 2.5 Gbps. But due to the dispersion in optical fiber communication bit rate and other parameters (like Q-factor, Threshold value) are affected (Reduce). Here dispersion compensation fiber (DCF) is used to minimized dispersion in optical fiber communication.**

Keywords: ***BER improvement, Modulation techniques, Optimization, NRZ, Chromatic dispersion, PMD, DCF, Q-factor, Threshold value, Dense WDM.***

I. INTRODUCTION

WDM Networks deals with everlasting demand for bidirectional Information transmission. These systems are Protected to Interference and offers very large Bandwidth, Flexibility and very high level of reliability. However some parameters like Tempering, Dispersion, Coupling and bending losses degrades its performance. Attenuation can also be reduced up to zero level by processing the signal through power amplifiers as well as bending and coupling losses can also be reduced by careful system design. The enormous bandwidth of optical fiber provides a potential to transmit signal at very high speed, yet this bandwidth cannot be completely utilized a significant reason is the fiber dispersion. Usually the fiber dispersion contains intermodal dispersion and polarization mode dispersion (PMD).

In single mode fiber intermodal dispersion is low & the system used today intermodal dispersion is not a significant problem. Polarization mode dispersion (PMD) is the main limitation that confines the optical fiber transmission from utilizing the bandwidth efficiency. However Dispersion is the main parameter which needs to be compensated for faithful signal transmission Fiber Bragg's Grating is one of the explanation to compensate it, but only up to a certain level. But by using DCF technique we can minimize intermodal dispersion as well as Polarization mode dispersion (PMD). So this technique improve the performance of the system parameters.

II. SYSTEM MODEL

Basic block of the proposed method is given bellow-

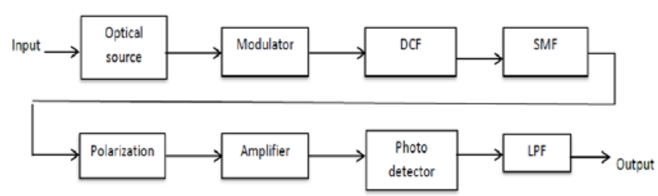

Fig. 1.1Block diagram

III. PREVIOUS WORK

In 2003 Winzer et alproposed an optimized design to compensate the fiber dispersion. The gain of EDFA also does a leading role in the transmission. The gain of the EDFA should be well defined for error free transmission. Because if we select too much gain then there will be non-linearity effect and if we choose less gain then the signal will be degraded. If the signal power is improved then there will also the non-linearity effect. That is why an optimization is compulsory for the EDFA gain. So for this system design they checked the gain several times and found the optimized gain for EDFA as 15.8 dB & 16 dB for single link and WDM system respectively. They noted that Most of the developing countries existing telecommunication network has the single optical fiber link for voice and data transmission. With a few modifications of the element's parameter in the link as mentioned here we can upgrade the single link up to 40 Gbps. And after that just applying the WDM system we can upgrade the transmission capacity up to 320 Gbps

In 2009 Buchali et alObserved that at the WDM receiver, the signal optical field is first reconstructed, e.g., by coherent detection then reverse signal processing is applied to recover the original data. OFDM enables efficient compensation of transmission effects such as chromatic dispersion and polarization mode dispersion that often are prohibiting impairments to cost-effective realization of high-speed optical transport systems. In light of the emerging demand for a 100Gb/s data rate in future optical transport systems, optical OFDM is considered to be a promising enabling technology. In this paper performance under various system conditions was discussed and compared with alternative technologies.

In 2011 Alam et al Described that the Bit Error Rate (BER) is an indication of how often data has to be retransmitted because of an error. The different modulation techniques scheme is proposed for improvement of BER in fiber optic communications. The developed scheme has been tested on optical fiber systems operating with a non-return-to-zero (NRZ) format at transmission rates of up to 10Gbps. Performance of improved detected signals has been evaluated by the analysis of quality factor and computed BER. Numerical simulations have shown a noticeable improvement of the system BER after implementation of the suggested processing operation on the detected electrical signals at central wavelengths in the region of 1310 nm.

Numerical simulation shows a noticeable improvement of the system BER after optimization of the suggested processing operation on the detected electrical signals at central wavelengths in the region of 1310 nm. The optimum solution reduces the bit error rate by using RZ signal generator through Electro-Absorption modulation techniques.

The operation of optical transmission networks will be most important features in the near future to serve the ever increasing demand of Internet Protocol (IP) networks. However, a lot of research works needs to be carried out to improve the increasing effective data transmission through these systems.

IV. PROPOSED METHODOLOGY

Dispersion management refers to the approaches to circumvent the transmission degradations caused by different types of single mode optical fiber and other nonlinear passive optical devices. Hence multiple sections of constant dispersion single-mode fiber (SMF) and dispersion-compensating elements whose lengths and group velocity dispersion are chosen to optimize the overall transmission performance of an optical fiber communication system are usually employed.

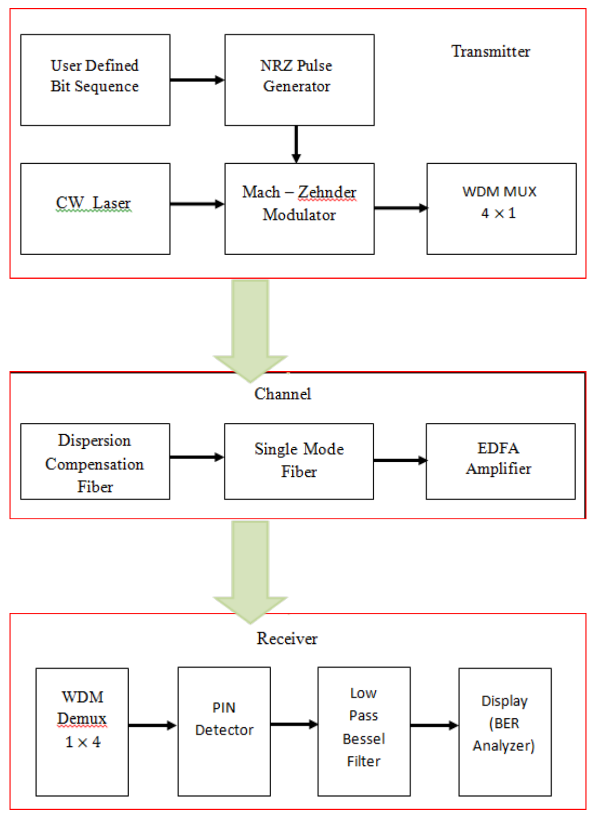

Fig. 4.1 Block diagram of the proposed model (For 4-channel)

The Simulation model of Receiver and transmitter for optical fiber Communication is implemented on "OPTISYSTEM-7.0" software by using SMF distanceupto200 KM long. A sequence generator with sequence =10101100, Bit rate 2.5 Gaps is considered. Here NRZ pulse generator has extreme amplitude of 1 a.u. and both Rise and fall time is 0.05 bit. A CW laser is employed as an optical source having frequency value of 193.1 THz with the sweep power level 13 dBm. MZM has the Excitation ratio 30 dB and symmetry factor -1.In the loop control system 2 loops have teken. The PIN photo detector have the Responsitibity 1 A/W and Dark current 10 nA and the down sampling rate is 800 GHz for the central frequency 193.1 THz and considering thermal noise 2.048e-023 W/Hz. The Random seed index is taken 11 with the filter sample rate 5 GHz.

In this model we proposed dense wavelength division multiplexing (DWDM) having channel spacing 0..50nm. In this model MUX and DEMUX have depth 100dB, bandwidth 10GHZ and a second order Bessel filter. In the dense WDM system channel spacing should be 100GHZ to 12.5 GHZ (0.1nm to 0.8nm at 1550nm) and Total number of channel can be increased up to any extent by using minimum channel spacing.

V. CONCLUSION

In the previous work which was discuss in literature review shows that there is need to improvement in system in terms of Q-FACTOR, MIN BER and THRESHOLD value. These parameters will be improved by minimizing dispersion in the system model. In the Proposed method dispersion compensation fiber (DCF) Technique is used to minimize dispersion and to increase system parameters compared to other compensation technique and reference model . Throughout the analysis of simulation outcome it is also observed that BER pattern is much better than other available methods for dispersion compensation.

VI. FUTURE SCOPES

- DCF Technique can be used for higher bit rate transmission above 100 GHz range in OFDM Networks, where synchronization is a serious issue.

- Dispersion free optical fiber channel can be obtained with some future work on proposed technique.

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