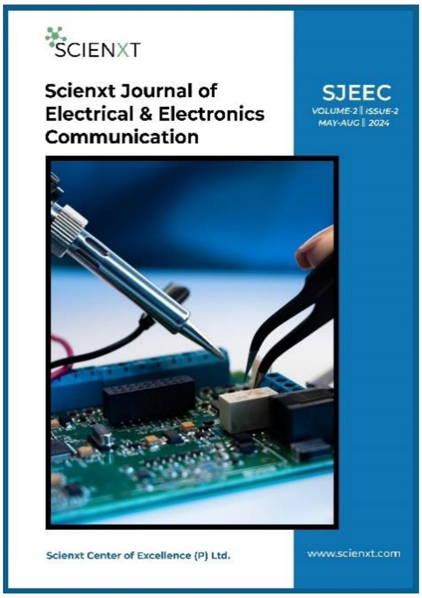

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Review of a noval approach for dispersion compensation in optical system with a fiber bragg grating

Shivam Chaturvedi
Student, Department of Electronics& Electronics Engineering, Bhopal Institute of Technology & Science Bhopal (M.P) India

Shivesh Gupta
Student, Department of Electronics& Electronics Engineering, Bhopal Institute of Technology & Science Bhopal (M.P) India

Subhash Chandra
Student, Department of Electronics& Electronics Engineering, Bhopal Institute of Technology & Science Bhopal (M.P) India

Vinay Kumar Gupta
*Vinay Kumar Gupta, Assistant Professor, Department of Electronics& Electronics Engineering, Bhopal Institute of Technology & Science Bhopal (M.P) India

**Corresponding Author: Vinay Kumar Gupta*
Email: vinaygupta.jnct@gmail.com

Abstract:

In optical communication system to compensate dispersion Fiber Bragg grating (FBG) is one of the applicable and important components. Here we are calculating best amount of parameters by simulating the model and then observe the effect of this component in data receiver. To tackle the nonlinear effects of transmission system Fiber Bragg grating has been employed with optisystem software very length. The analysis based on the chromatic dispersion.

We are design system with fiber Bragg grating and without fiber Bragg grating and very the length. The role of the communication channel is to transport the optical signal from transmitter to receiver without distorting it. Most light wave communication systems use optical fibers as the communication channel because fibers can transmit light with a relatively small amount of power loss. Fiber loss is, of course, an important design issue, as it determines directly the repeater spacing of a long-haul light wave system. Another important design issue is fiber dispersion, which leads to broadening of individual pulses inside the fiber.

1. Introduction:

Now a day's communication is major research section. We are work to transmit data in high distance without any noise so we are design different type of system. Optical fiber transmission systems are designed, analyzed and simulated to get long length of fiber. The performance of optical fiber on optical signals is characterized by chromatic dispersion, background loss, polarization mode dispersion (PMD) and nonlinearity. Through an optical fiber, transmit information from one place to another by transmitting light pulses; this method is called fiber-optic communication**.** Electromagnetic carrier wave is modulated to carry information. In the 1970s first developed, fiber- optic communication systems have transform the telecommunications industry and have played an important role in the advent of the Information Age. Chromatic dispersion and polar mode dispersion occurs in single mode fiber (SMF). In optical system dispersion can be compensated by also using erbium doped fiber amplifier (EDFA). Chromatic dispersion broadening the pulse of optical fiber and causes inter symbol interference (ISI). Compensation But there are several drawbacks of using dispersion compensating fiber, such as high nonlinearity and high insertion loss.

We are design two system one is with FBG and another FBG to check the which is best system which is provide best output and cover long distance so finally achieve we work without FBG only 60 km and after it does not provide proper dispersion and with FBG is give best dispersion in 60 to 80 km.

The basic function of optical fiber is to transport a signal from one location to other location through communication equipment for ex. A computer, video device or telephone with high reliability and accuracy. The main constituents of an optical fiber communication link are information sources, optical transmitter, optical connectors, cabled optical fibers, optical amplifiers, passive or active optical devices and optical receivers. One of the most important elements in an optical fiber link is cabled fiber. In optical fiber communication the phase velocity or group velocity of a wave depends on the frequency it is called dispersion. In optical fiber due to dependence of group index to wavelength chromatic dispersion occurred.

There are two bands in the third transmission window which are conventional or C-band from approximately 1525nm – 1565nm and the other one is long or L-band from approximately 1570nm – 1610nm.

2. Fiber bragg grating (fbg):

FBG is a type of common single mode fiber that is like a grating. The Bragg conditions satisfied propagated light, in a FBG core is resonated by grating structure and reflected wave. The gratings distance specifies the reflected wavelength, so that, from transmission spectra reflected light is removed in Bragg wavelength. A fiber Bragg grating is a type of distributed Bragg reflector constructed in a short segment of optical fiber that reflects particular wavelengths of light and transmits all others. This is achieved by creating a periodic variation in the refractive index of the fiber core, which generates a wavelength specific dielectric mirror. A fiber Bragg grating can therefore be used as an inline optical filter to block certain wavelengths, or as a wavelength- specific reflector. The first in-fiber Bragg grating was demonstrated by Ken Hill in 1978.Initially, the gratings were fabricated using a visible laser propagating along the fiber core. In 1989, Gerald Meltz and colleagues demonstrated the much more flexible transverse holographic inscription technique where the laser illumination came from the side of the fiber

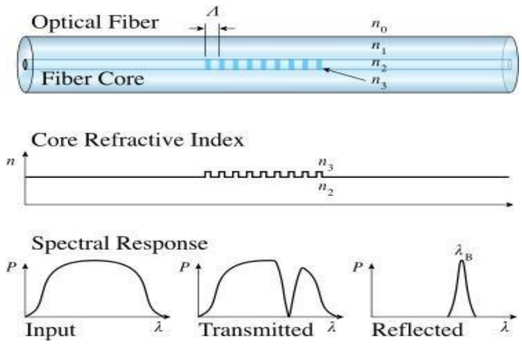


Figure. 1: FBG

This instrument performs some operations like reflection and filtering with high efficiency and low loses. Some variations are created in period of gratings (as result variations along the grating in a chirp FBG. There is a delay occurred in wavelength with different time intervals, along the axis the period of grating changes, different wavelengths are reflected by different parts of grating. In a communication link chromatic dispersion can be compensated and compression in incident pulse occurred finally. Most important reason to use chirp FBGs than all other suggested types, are cost efficiency and low internal lose nonlinear effects.

2.1. Operating principle of FBG:

As Shown in Figure, FBG is there is an enclosement of alternative modulation of refractive index which acts like a wavelength selective mirror. FBGs were firstly percept as a result of strong argon ion laser radiation to a fiber with germanium dope. Afterwards, there so many methods were employed in order to map grating in optical fiber in which comprehensive types of pulsed and continuous lasers were used in visible and ultraviolet region (Raman, 1999; Othonos and Kyriacos, 1999; Marcuse, 1994). As a result according to Bragg wavelength, gratings selectively reflect the propagated light in fiber which is given as follow:

$\lambda B=2n\Lambda$..(1)

In the equation (1), n and Λ are refractive index of core and grating period in fiber, respectively. A uniform grating can be shown as sinusoidal modulation of fiber core refractive index (Martin, 2004):

$n(z)= ncore +\delta n\ [1 + \cos(2\pi z/\Lambda +\varphi(z))]$

………………………………………..(2)

In which n core is the core refractive index when it is not radiated and δn is amplitude of induced refractive index variations.

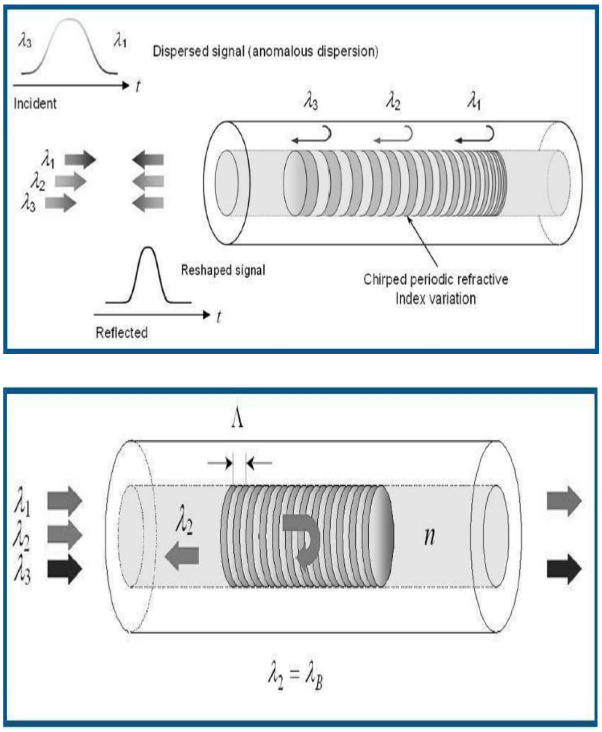


Figure. 2: Principle of Operation of a FBG

The fundamental principle behind the operation of a FBG is reflection. Where light traveling between media of different refractive indices may both reflect and refract at the interface.

The refractive index will typically alternate over a defined length. The reflected wavelength ( ), called the Bragg wavelength, is defined by the relationship,

$$\lambda_B = 2n_e\Lambda$$

Where n_e the effective refractive index of the grating in the fiber is core and is the grating period. The effective refractive index quantifies the velocity of propagating light as compared to its velocity in vacuum. Depends not only on the wavelength but also (for multimode waveguides) on the mode in which the light propagates. For this reason, it is also called modal index.

The wavelength spacing between the first minima (nulls, see Fig. 1.1.1), or the bandwidth ( ), is (in the strong grating limit) given by,

$\Delta\lambda$

$$\Delta\lambda = \left[\frac{2\delta n_0 \eta}{\pi}\right] \lambda_B$$

Where δn_0 is the variation in the refractive index ($n_3 - n_2$), and η is the fraction of power in the core. Note that this approximation does not apply to weak gratings where the grating length Lg is not large compared to λ_B / δn_0.

The peak reflection ($P_B(\lambda_B)$) is approximately given by,

$$P_B(\lambda_B) \approx \tanh^2 \left[\frac{N\eta(V)\delta n_0}{n}\right]$$

Where N is the number of periodic variations, the full equation for the reflected power ($P_B(\lambda)$), is given by,

$$P_B(\lambda) = \frac{\sinh^2\left[\eta(V)\delta n_0 \sqrt{1-\Gamma^2}\frac{N\Lambda}{\lambda}\right]}{\cosh^2\left[\eta(V)\delta n_0 \sqrt{1-\Gamma^2}\frac{N\Lambda}{\lambda}\right] -}$$

Where,

$$\Gamma(\lambda) = \frac{1}{\eta(V)\delta n_0}\left[\frac{\lambda}{\lambda_B} - 1\right]$$

2.2. Chirped fiber bragg gratings:

The refractive index profile of the grating may be modified to add other features, such as a linear variation in the grating period, called a chirp. The reflected wavelength changes with the grating period, broadening the reflected spectrum. A grating possessing a chirp has the property of adding dispersion— namely; different wavelengths reflected from the grating will be subject to different delays. This property has been used in the development of phased- array antenna systems and polarization mode dispersion compensation, as well. Grating period and refractive index modulation depth can be controlled to create Chirped FBG with the length of the FBG by using advanced fabrication technique and production facilities. The process of chirped FBG for dispersion compensation was firstly introduced by Quellete and later was demonstrated by Williams's et.al. Chirped FBG can be demonstrated as an in-filter broadband reflective optical fiber. Therefore there is a delay occurred to the shorter wavelength, related to longer wavelengths. The entire wavelength in the light pulse should be comes out at the same time so that chirped grating can be designed to equalized or nullified the dispersion in the optical pulse. As shown in Fig. 1.1.1, different wavelengths are reflected from different parts of grating when a signal enters into chirp. Thus, grating produced a delay related to wavelength of signal. This feature is used for dispersion compensating in communication links.

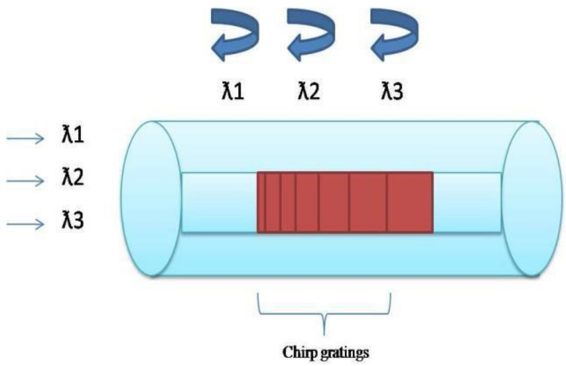


Figure. 1.2.2: Chirped Fiber Bragg Gratings

3. Dispersion:

In single mode fiber chromatic dispersion occurs due to the inherent property of silica fiber in which the refractive index varies with wavelength. Therefore, at slightly different speeds within the fiber different wavelength channels will travel.

Because of this spreading of the transmission pulse takes place as it travels through the fiber. Chromatic dispersion in optical fiber is created because of the dependence of group index to wavelength. Some data are missing due to spreading of pulses. It should be minimized so that original data can be attained. Dispersion compensation is the process of designing the fiber and compensating element in the transmission path minimize the total dispersion. In other sentence dispersion compensation can be referred as the control of overall chromatic dispersion of the system.

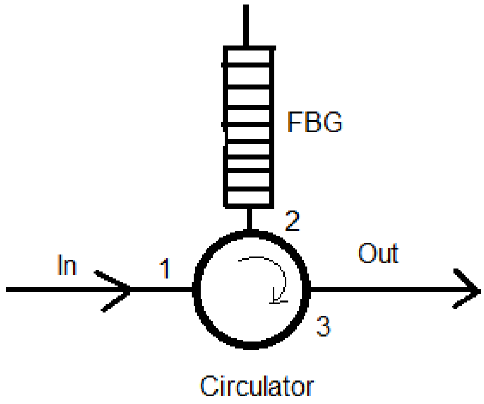


Figure. Dispersion

3.1. Bit sequence generator:

A user defined bit sequence generator was used with 40 Gb/s data rate and the bit sequence is defined as 00010000.with the number of trailing zeros (time window *3/100)

*bit rate).An optical secant hyperbolic pulse generator frequency 193.1Thz, power is 34.34 dbmW and mw width is 0.5 bit with linear chirp definition and zero chirp factor of azimuth and ellipticity polarization of zero degrees. The solution of the fiber model is done in the above mentioned methods Case (1)propagation type is scalar, exponential ,non iterative constant step size and maximum nonlinear phase shift of 27.6 mrad .3.9482 kms length. The maximum amplitude in this case is 4.076 watts and the minimum amplitude is .45025watts

3.2. Rz pulse generators:

Most installed fibers are standard single mode fibers (SMF) with high group velocity dispersion values (~ 16ps/nm/km) at 1.55 µm. To achieve a good level of bit-error- rate (BER) as well as to enable larger repeater spacing and larger signal-to-noise ratio (SNR) in this type of fiber, it is very important to consider the influence of group velocity dispersion, nonlinear effects, PMD, and their interplay on the transmitted signals. Increasing the capacity of optical systems may require either an increase in the bit rate, usage of WDM or ultimately both. At high bit rates, the modulation format, type of dispersion compensation scheme, and channel power become important issues for optimum system design. When dealing with large WDM systems, as RZ modulation causes a significant Eye Closure Penalty near end channels. The results obtained in this tutorial will be used to compare the Eye Closure Penalties for RZ cases, as well as the effects of nonlinearities.

We demonstrate two most used modulation formats in optical communications – non return-to-zero (NRZ) and return -to-zero (RZ)

- as well as two additional variants of RZ format chirped RZ (CRZ) and carrier- suppressed RZ

(CSRZ). Each link consists of PRBS generator, transmitter, optical filter, and attenuator, receiver, and BER tester. Transmitters represented as compound components blocks, i.e. combination of blocks. For example, NRZ transmitter combines CW Laser source, Electrical signal generator (NRZ driver), external Mach-Zehnder modulator, and attenuator. The following parameters of transmitter can be set: power, wavelength, extinction ration, rise/fall time, RIN, etc. In case of RZ transmitter the electrical signal generator generate RZ signal with raised cosine shape and given duty cycle. In CRZ transmitter we add a chirp to RZ optical by applying a phase modulation. And finally in case of CSRZ transmitter the RZ optical signal after Mach-Zehnder modulator goes through phase modulator driven by analog sine wave generator at frequency equal to half of the bit rate. That will introduce a pi phase shift between any two adjacent bits and the spectrum will be modified such that the central peak at the carrier frequency is suppressed.

3.3. Amplitude modulator:

Amplitude modulator is key element of optical communication. Amplitude modulation is one of the earliest radio modulation techniques. Amplitude modulation (AM) is a modulation technique used in communication, most commonly for transmitting information via a radio carrier wave. AM works by varying the strength (amplitude) of the carrier in proportion to the waveform being sent? That waveform may, for instance, correspond to the sounds to be reproduced by a loudspeaker, or the light intensity of television pixels.

The standard amplitude modulation equation is:

$$e_{am} = (1 + m \sin \omega_m t) \sin \omega_c t$$

From this we notice that AM involves a multiplication process. There are several ways to perform this function electronically. The simplest method uses a switch.

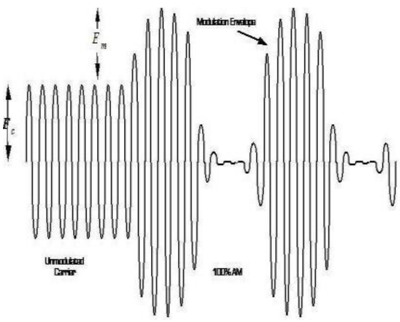


Figure.1.6: Amplitude Modulator

3.4. Cw laser:

CW laser generated spectrum which is spread pulse width of the signal. It is transmitter element which is use as a carrier signal generator in optical communication system. It is generate high pulse width signal. Since σw / Δω < < 1, for the spread of the pulse width, we can expect the validity of the following formula:

$$\frac{\sigma^2}{\sigma_0^2} = 1 + \left(\frac{\beta_2 z}{2\sigma_0^2}\right)^2 = 1 + \left(\frac{z}{L_D}\right)^2$$

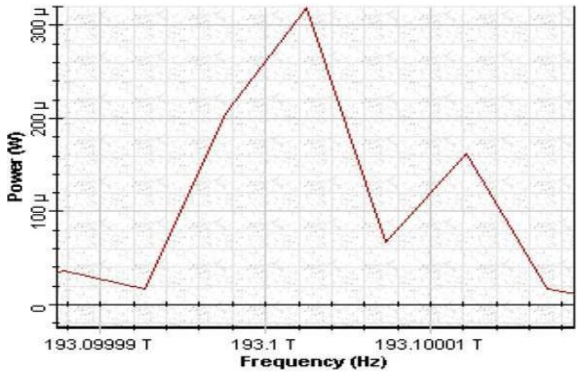


Figure. 1.7: Spectrum of CW Laser

3.5. Optical fiber:

An optical fiber is a flexible, transparent fiber made of extruded glass, silica or plastic, slightly thicker than a human hair. It can function as a waveguide, or light pipe, to transmit light between the two ends of the fiber. Of refers to the medium and the technology associated with the transmission of information as light pulses along a glass or plastic strand or fiber. Optical fiber carries much more information than conventional copper wire and is in general not subject to electromagnetic interference and the need to retransmit signals. Most telephone company long-distance lines are now made of optical fiber. Optical fibers are widely used in fiber- optic communications, where they permit transmission over longer distances and at higher bandwidths (data rates) than wire cables. Optical fibers typically include a transparent core surrounded by a transparent cladding material with a lower index of refraction. Light is kept in the core by total internal reflection. This causes the fiber to act as a waveguide. Fibers that support many propagation paths or transverse modes are called multi-mode fibers (MMF), while those that only support a single mode are called single-mode fibers (SMF). Multi-mode fibers generally have a wider core diameter, and are used for short-distance communication links and for applications where high power must be transmitted. Single-mode fibers are used for most communication links longer than 1,000 meters (3,300 ft). We design maximum 80km length for the best output of transmission of optical communication.

3.6. Erbium-doped fiber amplifiers:

EDFA is an optical repeater device that is used to boost the intensity of optical signals being carried through a fiber optic communications system. An optical fiber is doped with the rare earth element erbium so that the glass fiber can absorb light at one frequency and emit light at another frequency. An external semiconductor laser couples light into the fiber at infrared wavelengths of either 980 or 1480 nanometers. This action excites the erbium atoms. Additional optical signals at wavelengths between 1530 and 1620 nanometers enter the fiber and stimulate the excited erbium atoms to emit photons at the same wavelength as the incoming signal. This action amplifies a weak optical signal to a higher power, affecting a boost in the signal strength.

Fiber optic use in the 1980s required the light signals to be converted back into electronic signals at the data's final destination. EDFA removes this step from the process: all the steps of its operation are the actions of photons, so there is no conversion of optical signals to electronic signals.

Erbium had little commercial uses before the age of fiber-optic telecommunications. Now it is an important constituent of signal repeaters in long-distance telephone cables.

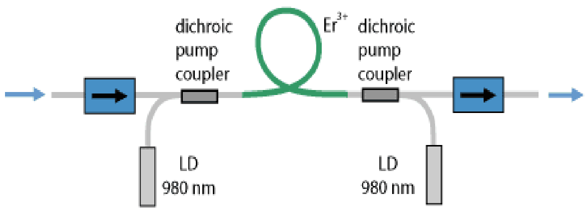


Figure. 1.9: EDFA

4. Simulation of a transmission system to compensate dispersion in an optical fiber by chirp gratings:

Author: S. O. Mohammadi, Saeed Mozaffari and M. Mahdi Shahidi

In this work, we simulated a communication system in information transmission. As soon as we observed dispersion, we decided to compensate it in order to receive data in receivers as they are. To this purpose, we employed chirp FBG and simulated it. Also, it can be obtained that increase in grating length leads to decrease in pulse extension, and also increase in its power. By considering the power of the output spectrum of modulator and the pulse shape in that point, the most suitable length which equals to 6 mm can be resulted. Apodization function is not very effective in FBG reflected spectrum, although the best shape is Tanh function because of its grating length. Finally, it can be understood that the pulse was broadened and its power increased as a result of the increase in chirp parameter which is the best amount.

4.1. Computer simulation of 40 gb/s optical fiber transmission systems with a fiber grating dispersion compensator:

Author: Huang Liqun , Song Xin ; Liu Fulai ; Shen Li

In this paper, high-bit rate transmission systems with a chirped fiber grating dispersion compensator are investigated and simulated by solving nonlinear schro dinger equations.

Due to the effect of non-ideal dispersion and reflection characteristics of traditional apodized linearly chirped fiber gratings, the degradation of eye diagrams is very serious in 40Gb/s NRZ-transmission systems. Then, a dispersion compensator based on chirped fiber grating is designed by the layer peeling algorithm. After 40Gbit/s transmission over 800Km of standard single-mode fibers, the eye diagram is still clear, and the power penalty is only 0.45dB for this dispersion compensator.

Author: Gnanagurunathan, Rahman, F.A.

The Simulation results show that: the chirped fiber grating designed by the layer peeling algorithm has excellent performances as the dispersion compensator in high-bit-rate transmission systems.

A Simulation study on DCF compensated SMF using OptSim

Author: Sujith, Gopchandran, K.G.

In this report an analysis of the performance limitations of SMF due to SPM effect is discussed. With the aid of OptSim simulation software a DCF has been employed with proper variation in length to tackle the nonlinear effects in the transmission system. Better performance was shown when a combination of SMF length 85km and DCF length 15km was chosen. The BER and eye diagram technique have been used for evaluating the system performance.

4.2. Comparing FBG and DCF as dispersion compensators in the long haul narrowband WDM systems:

Author: Gnanagurunathan, Rahman, F.A.

In this paper proposed evaluated the chromatic dispersion compensation for a long-haul WDM transmission. A channel optical network was modeled, simulated and analyzed at a 600 km distance using two chromatic dispersion compensators i.e. fiber Bragg grating (FBG) and dispersion compensated fiber (DCF). Subsequently the modulation scheme and also the traffic load are varied to determine the robustness of the compensators to sustain the changes imposed on the light wave optical system. This analysis concludes that the grating device seems to be the better compensating solution for the long haul narrowband transmission. In addition, the FBG is also able to sustain the changes in traffic load and modulation scheme much better than the DCF.

5. Problem formulations:

Optical communication, also known as optical telecommunication, is communication at a distance using light to carry information and travel source to destination. It can be performed visually or by using electronic devices. An optical communication system uses a transmitter, which encodes a message into an optical signal, a channel, which carries the signal to its destination, and a receiver, which reproduces the message from the received optical signal. For optical communication main problem is distraction of communication and another is power consumption of system. We have found this is problem in base paper it is optical fiber length is 10 km we optimized it and design 80 km without more desperation and chirp size.

In the base paper the distance is only 10 km. This means that the entire optical transmission process is to be repeated which will make the transmission system more complex and costlier. Thus distance between two optical stations must be increased

6. Proposed methodology:

6.1. Methodology:

1. Simulation Tool (Optisystem simulator)
2. Without FBG
3. With FBG

6.2. Optisystem simulator:

Optisystem is a software for the testing, optimization and design of any type of optical link in the physical layer of the broad spectrum of optical networks, to local area networks (LANs) and metropolitan area networks (MANs) from long haul systems. Optisystem is complete optical communication system simulation package. In fiber optic communication systems system level simulator is based on the realistic modeling of it, a truly hierarchical definition of components and new simulation environment and systems.

OptiSystem is an optical communication system simulation package for the design, testing, and optimization of virtually any type of optical link in the physical layer of a broad spectrum of optical networks, from analog video broadcasting systems to intercontinental backbones. A system level simulator based on the realistic modeling of fiber-optic communication systems, OptiSystem possesses a powerful simulation environment and a truly hierarchical definition of components and systems. Its capabilities can be easily expanded with the addition of user components and seamless interfaces to a range of widely used tools. OptiSystem is compatible with Optiwave's OptiAmplifier and OptiBPM design tools.

OptiSystem is an innovative, rapidly evolving, and powerful software design tool that enables users to plan, test, and simulate almost every type of optical link in the transmission layer of a broad spectrum of optical networks from LAN, SAN, and MAN to ultra-long-haul. It offers transmission layer optical communication system design and planning from component to system level, and visually presents analysis and scenarios. Its integration with other Optiwave products and design tools of industry leading electronic design automation software all contribute to OptiSystem speeding your product to market and reducing the payback period.

6.3. Simulation tools:

Fig. show below are the basic tools and steps used in OptiSystem Software to initial start of the system.

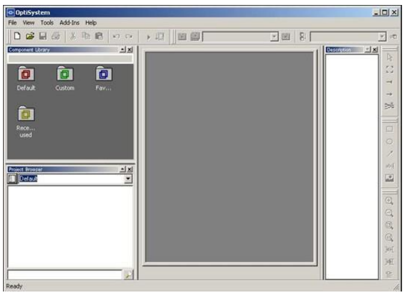


Figure. 4.1.1.1: Optisystem Graphical User Interface (GUI)

6.4. Main parts of the GUI:

The OptiSystem GUI contains the following main windows:

- Project layout
- Dockers

- Status Bar
- Component Library
- Project Browser
- Description

The main working areas where you insert components into the layout, edit components, and create connections between components.

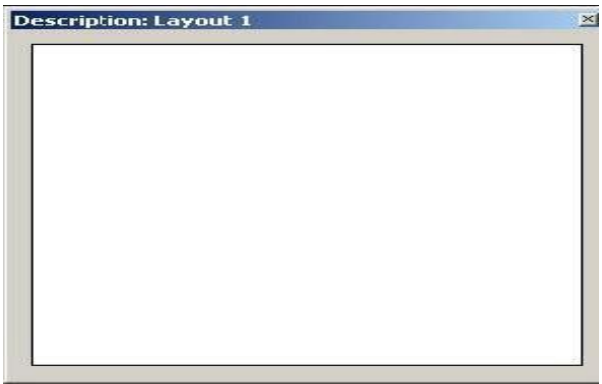


Figure. 4.1.1.2: Project Layout Window

6.5. Component library:

Access components to create the system design. It library have the entire component which is used to optical communication. It is generally design as the part of flexibility all the component have their respective category like transmitter, receiver etc.

Figure. 4.1.1.3: Component Library Window

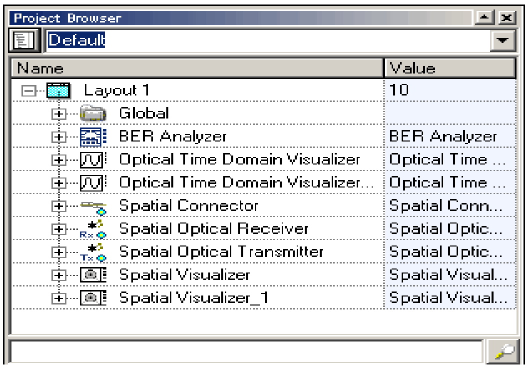


Figure. 4.1.1.4: Project Browser Window

6.6. Without FBG:

In order to simulate the system we use the parameter in Table. 2. The model of this simulated system is shown in Fig. 4.1.1.4.

In this simulation, we use a continuous wave (CW) laser with frequency of 193.1 THz and the output power is 1 MW which is modulated with a return to zero (RZ) pulse generator at a 10 Giga bits/s user defined bit sequence generator in an Amplitude modulator. In this model employed EDFA has the gain amount of 6dB, independent of wavelength and ignorable noise which is only used to compensate dispersion and nonlinear effects of transmission system.

The main disadvantage of communication system is that the data given as the input are not same as the gained output. A compensator is introduced to give a dispersion index equal with opposite sign. Firstly we are giving user defined input 10Gbps through user defined bit sequence generator to RZ pulse generator. Through CW laser, in the varying period's information is carried. Am modulator is used to superimposing the low frequency signal on a carrier signal of high frequency. Single mode fiber amplifies optical signal directly. To calculate the result we are using eye diagram analyzer through which signal to noise ratio can be observe and then bit error rate will be find. In the system length of fiber is increasing and through the comparison of bit error rate we can analyze the compensation in the dispersion. In the first graph there is a comparison of length of fiber and bit error rate. It is known that the bit error rate should be less than 10^{-6}. After sweeping the length from 10 to 100 km we find that the signal can be reached at 60 km only without or less dispersion. The table 2 shows all the parameters used in the model the dispersion effect given is 16.75ps/km/nm. Through the eye diagram analyzer we calculate signal to noise ratio and from which we get Q factor. Figure 4 shows the comparison between length of fiber and bit error rate through the graph. The simulated optical communication system evaluated from the basis of bit error rate. Bit error rate should be low to increase the quality of reception of signal.

Table. 4.1.2: FBG Parameter

Parameters	*BER*
Dispersion (ps/km/nm)	16.75
Dispersion slope (ps/nm2/km)	0.075
Attenuation index	0.2
Length of fiber (km)	60

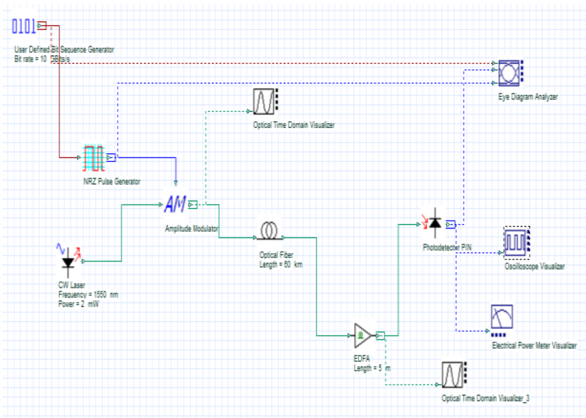
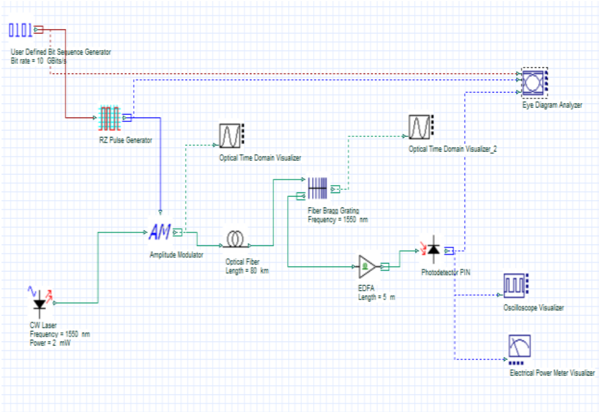


Figure. 4.1.2: Transmission system without use of FBG

6.7. Transmission system Use FBG:

The transmission system model includes a user defined bit sequence generator, return-zero (RZ), a continuous wave (CW) laser with frequency 193.1 and output power 1MW and an AM modulator. The modulation of signal done with a return-zero user defined sequence in AM modulator. The output of system1 is fed into optical fiber whose length is 80km, dispersion is 16.75ps/km/nm, dispersion slope is 0.050pm/nm2/km, and attenuation index is 0.20km. Now to get a better result or to achieve a better signal the dispersed wave goes into the chirp fiber

Bragg grating. The parameters involved in chirp FBG are frequency, effective refractive index, length of grating, apodization function, Tanh parameter, chirp function. Linear parameter and their values are 193.1THz, 1.45, 6, Tanh, 5, linear and 0.0001 respectively. The amplification of signal done through EDFA amplifier which has a gain amount of 6dB. The receiver side



consists of a photo detector (PIN) and eye diagram analyzer.

Figure. 4.1.3 (a): Transmission System Use of FBG

6.8. Applications:

- Chirped FBG not only helps in minimizing the cost of the transmission system but also has low loss insertion.
- EDFA amplifies optical signal because of their high gain and low noise.
- It can be provided high speed, better bandwidth and high capacity.
- Symmetric high capacity access network with high spectral efficiency, cost effective, good flexibility

7. Conclusion:

Above Design in information transmission communication system is simulated. To get better result chromatic dispersion should be compensated in optical fiber. We increase the length of fiber to transmit the signal to long length with less dispersion. The length we gained is 60 km which is better for the system than the other.

Second Design we employed a chirp FBG to simulate and compensate the dispersion in a communication system in information transmission. Whenever we increase the length of grating the extension of pulse will be decreased because of that the signal will be cover more length without or less dispersion. So the quality of signal will be same at the receiver as the transmitter. The efficiency will be high and the cost will be low by using chirp fiber Bragg grating.

8. Future scope:

Instead of using fiber Bragg grating for compensating dispersion, other techniques like short period dispersion-managed fiber and dispersion compensation fiber component can be used. By using these techniques dispersion is reduced considerably by which even higher data rate can be transmitted over longer length fiber by keeping higher Q-factor and lower BER. Instead of using EDFA for amplification Raman Amplifier can be used.

9. References:

(1) S. O. Mohammadi1, Saeed Mozaffari1 and M. Mahdi Shahidi2 — Simulation of a transmission system to compensate dispersion in an optical fiber by chirp gratings —. International Journal of the Physical Sciences Vol. 6(32), pp. 7354 - 7360, 2 December, 2011.

(2) Huang Liqun, Song Xin, Liu Fulai, Shen Li, and Han Laiquan —Computer Simulation of 40Gb/s Optical Fiber Transmission Systems with a Fiber Grating Dispersion Compensator —20IO International Conference On Computer Design And Appliations (ICCDA 2010)

(3) S Sujith and K G Gopchandran —A Simulation study on DCF compensated SMF using OptSim‖. 2010 International congress on Ultra-Modern Telecommunications and Control Systems and Workshops (ICUMT) 978-1-4244- 7286-4/10/$26.00 ©2010 IEEE Department of Optoelectronics, University of Kerala,Thiruvananthapuram - 695 581, India)

(4) Gnanam Gnanagurunathan, Faidz Abd. Rahman —Comparing FBG and DCF as dispersion compensators in the long haul narrowband WDM systems‖ .

(5) Isabelle Riant, Salim Gurib, Josselyne Gourhant, Pierre Sansonetti, Christian Bungarzeanu, and Raman Kashyap—Chirped Fiber Bragg Gratings for WDM Chromatic Dispersion Compensation in Multispan 10-Gb/s Transmission‖ IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS, VOL. 5, NO. 5, SEPTEMBER/OCTOBER 1999 W. H. Loh, R. Laming, A. D. Ellis, et al., "10Gb/s transmission over 700km of standard single-mode fiber with 10-cm chirped fiber grating compensator and duobinary transmitter", IEEE Photon. Tech. Lett., Vol. 8, no. 9, pp.

1258-1260, 1996.

(6) Ming Li, Xuxing Chen, Junya Hayashi, et al. "Advanced design of the ultrahigh- channel-count fiber Bragg grating based on the double sampling method", Opt. Express Vol. 17, no. 10, pp. 8382-8694, 2009.

(7) G. P. Agrawal, "Nonlinear Fiber Optics", Second Edition, Academic Press, San Diego, 1989.