PERFORMANCE INVESTIGATION OF NON LINEAR EFFECT IN DWDM OPTIC NETWORK

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ABSTRACT:

The paper deals with the analysis of the non-linear effect on the Dense Wavelength Division Multiplexing (DWDM) fiber optical communication system. Non-linear effect most probably occurs due to the refractive index of the optical transmitting medium and also due to the scattering phenomenon. In this paper mainly the non-linear effect such as Four Wave Mixing due to refractive index has been analyzed and the FWM is the one of the main reason for the crosstalk in order to analyze the non-linear effect, the dispersion will be increased. By increasing the dispersion, the non-linear effect will gets decreased and observed using optical spectrum analyzerand eye diagram. The optical software tool OPTSIM is used to analyze the four wave mixing.

KEY WORD: Non-lineareffect, dense wavelengthmultiplexing (DWDM), dispersion, four wave mixing, OPTSIM.

I. INTRODUCTION:

Optical network is the one of the data communication network. Which was built by the optical fiber technology and the primary communication medium used in the optical network is transmitted via optical fiber cable and this cable is used to transmit data, i.e. transmitting the data will be in the form of light pulse between the transmitting node and the receiving node. And it uses the light signal instead of electrical signal for transmitting the information. Optical network comprises of optical transmitter, receiver fiber optic cables, optical switches and other optical component. Optical network can also be called as the optical fibernetwork, fiber optic network can be said as the photonicnetwork. Optical network is the one of the fastest communication networks. Some of the benefits of optical network are, itreduces the capital cost, it also reduces the distance limitation and also it improve the managelity, scalability and efficiency. Moreover, it is capable of achieving higher bandwidth. [1,2]

In fiber optic communication system Wavelength Division Multiplexing (WDM) is a one of the technologywhich multiplexes the number of optical carrier signal into a single optical fiber. This technique is widely used for bidirectional communication as well as for the multiplication of capacity [6]

The problem of non-linear effect mainly emerges in the year 1990.They were first ignored in the early period, but late in the year 1970 during the time of LASER development they were taken into the account. And mainly the issue of non-linearity occurs due to the expandable growth of the internet and the e-business, most probably the fiber optic truck lines are preferred for the various applications like video-on-demand, games-on-demand and also the 3G and 4G mobile services. Because of this large usage the data traffic takes place which results in the non-linearity effect. And also the main reason for the Non-linear effect can also be called as third order susceptibility.

Non-linear effect mainly occurs due to the refractive index of the transmitting medium and due to the scattering phenomenon. When the transmitting medium has high pulse, the refractive index will get change. Refractive index is nothing but when the light enters from one medium to another medium, there will be changes in the direction of propagation. Again the non-linear effect due to refractive index is classified into self-phase modulation, cross phase modulation, four wave mixing. And scattering effect is classified into stimulated Brillouin scattering and stimulated Raman scattering and in this analysis the FWMtakes place . FWM is a one of the intermodulation phenomenon.in these the two or more wavelengths combine to form a new

wavelength it will result in the degradation and also the cross talk will take place due to the four wave mixing. Interference and the additional noise are the main reason, which results in performance degradation. And also the four wave mixing depends on the following parameter such as dispersion, effective area, channel spacing.

II. PROPSED WORK

2.1 FOUR WAVE MIXING:

FWM is one of the intermodulation phenomenon. FWM is nothing but two or more wavelengths produce two or one newwavelength at different frequency. FWM effect is also called as the four photon mixing effect. Due to FWM cross talk will takes place it degrades the performance of the communication system. FWM is the phase sensitive process. Main reason for the FWM results in following problems [7, 8]

- Interference between the signal i.e. cross talk
- Additional noise generation result in performance degradation
- Power lost takes place[9]

The diagrammatic representation will clearly explains the concept of FWM (fig 1)

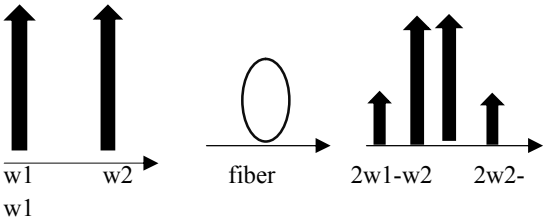

Fig 1 Diagrammatic representation of FWM

2.2 DENSE WAVELENGTH DIVISION MUX:

DWDM is defined as the dense wavelength division multiplexing. It is one of the optical technology, which is most probably used to increase the bandwidth. The working phenomenon of DWDM is nothing but it can combine and transmit multiple signal at different wavelength on the same fiber. In this single fiber can transmit the data at a speed rate of 400 GB/s .Now a days DWDM is widely available for many vendors.

And the difference between wave length division multiplexing and the dense wavelength division multiplexing is only two channel can be able to transmit. In the dense wavelength division multiplexing 64+ channel can be able to transmit. Dense wavelength division multiplexing is used for the long haul transmission.DWDM has the channel spacing 200nm.

III. SIMULATION SET UP

In this, the four wave mixing transmitter section, receiver section and the fiber section will be clearly discussed. (fig 2) sows the block diagram.

3.1 TRANSMITTER SECTION:

The transmitter section consists of a pseudo random sequence generator.which is used to generate 0's and 1's in the random sequence. The two laser inputs are given to the modulator.One will be in the form of continuous wave laser.Another input to the modulator.

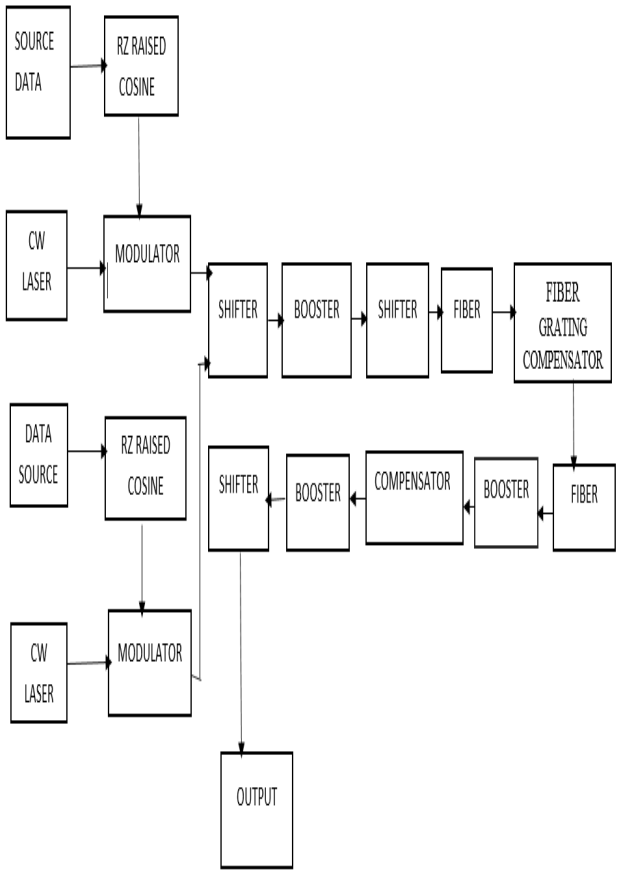

Fig 2Block diagram of four wave mixing

3.2 FIBER SECTION:

And in the fiber section fiber and fiber compensator are used. And the fiber grating compensator is called as the dispersion compensator which is used to vary the dispersion range.[10]

3.3RECEIVER SECTION:

In The receiver section, both the power meter and the output spectrum oscillator are used to obtain the result. And in the output spectrum analyzer the output of dispersion variation changes and the non-linear effect graphical representation will be analyzed

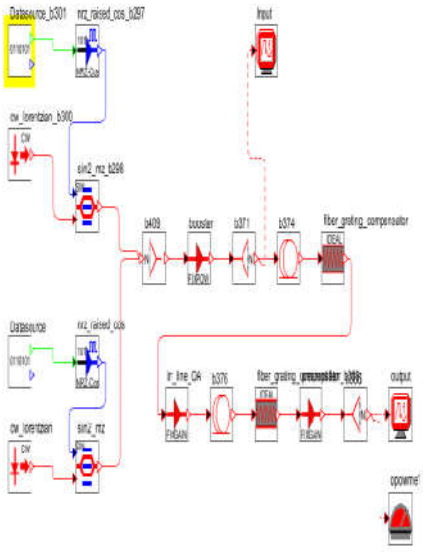

Table 1.Parameters for Simulation

PARAMETER USED:

PARAMETER	RANGE
Bit rate	10.0 GB/s
Baud rate	10 G/bauds
Wavelength	1552.45 nm
Dispersion	0-3 nm
Cw power	0.1 mw
Frequency	193.025 THz

The above shown a diagrammatic representation(fig 3) is the design of FWM of the optsim software tool.in this transmitter section,fiber section and the receiver section are connected.and the wavelength of 1550nm the data rate of 10bits/sec in order to analyse the non linear effect disperssion gets varied. From 0 to 4.while increasing the dispersion the nonlinear effect gets decreased.the parameter used for simulation is shown in table 1

Optsim is the optical software tool used for the communication purpose.it follows the split step algorithm.in this tool two modes are present,one is sample mode and the other one is block mode.for The analysis of non linear effect the sample mode will be analyzed ,in the sample mode select variable bandwidth simulation will be selected specifically.and in the variable bandwidth tool select full mode for the analysis of non linear effect in the four wave mixing.

IV. RESULT & ANALYSIS:

The graphical representation will clearly show the variation of the nonlinear effect

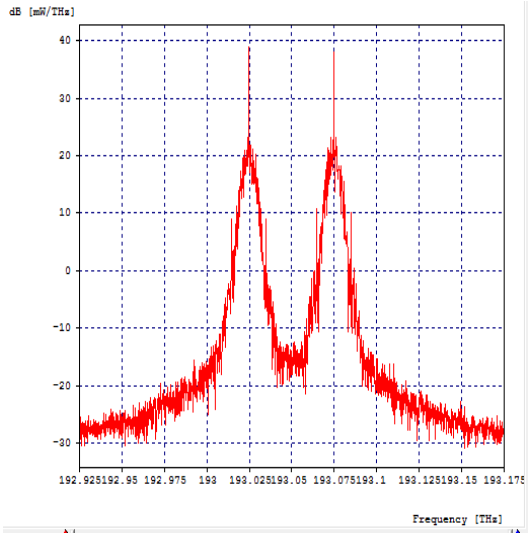

Fig 4. Input wave form

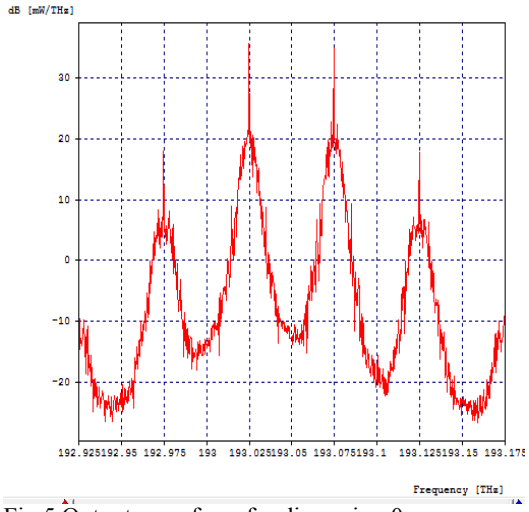

Fig 5.Output waveform for dispersion 0

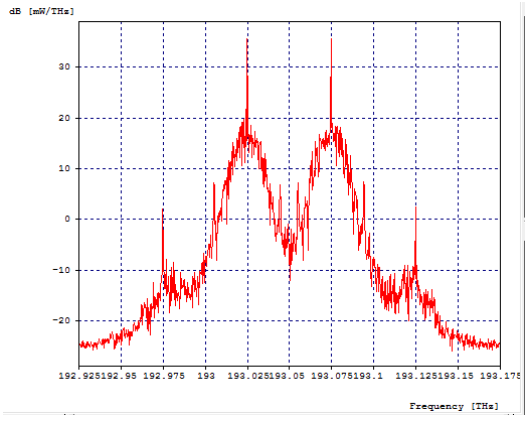

Fig 6. output waveform for dispersion 1

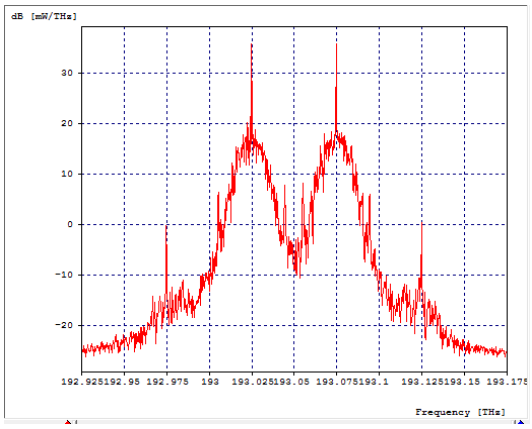

Fig 7. Output waveform for dispersion 2

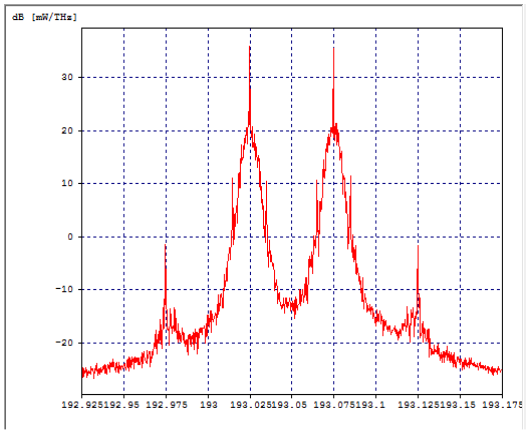

Fig 8.Output waveform for dispersion 3

The power level for the input modulation is 20db.The two inputs are given one in the form of laser and another in the form of pulse.And by increasing the value of dispersion from 0-3nm the nonlinear effect will get reduced.

CONCLUSION:

Among various nonlinear effects, FWMis studied and simulation is carried put using optsim software.For the various values of dispersion, power level is analysed. The dispersion is varied and power level is measured for different dispersion.

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