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A REVIEW ON GAIN AND PERFORMANCE ANALYSIS OF EDFA

[1]Himanshu Singh, [2] Sunny Tyagi

[1,2]M.Tech Communication Engineering,

School of Electrical, Electronics and Communication Engineering

ABSTRACT

Fiber loss is a fundamental limitation in realizing long haul point to point fiber optical communication links and optical network. One of the advance technology in the recent year is the advent of ERBIUM DOPED FIBER AMPLIFIER. It is essential element in DWDM .In this paper gain and performance analysis of EDFA has been studied.

Keywords: Noise Figure (NF), Pump Power, Optical Fiber

I INTRODUCTION

In the recent years , due to dramatic reduction in transmission bandwidth property we use optical fiber , an optical fiber is a flexible ,transparent fiber made by silica or plastic to a diameter slightly thicker than that of human hair. Optical fiber are used most often as a mean to transmit light between the two ends of fiber .wide use in fiber optical communication for a transmission over a longer distance and higher data rates. Optical fiber are use because of some property of optical fiber like, in optical fiber have, immunity to electromagnetic interference, data security, ease of installation, small size, high bandwidth. An optical amplifier is a device that amplify an optical signal directly without the need to first convert it to an electrical signal in optical fiber communication .EDFA(erbium doped fiber amplifier) are mostly used as preamplifier with multichannel amplification without crosstalk and also multi -gigabit transmission rates by low bit error. Most important EDFA technology is the (EDF), which is a conventional silica fiber doped with Erbium .EDFA is most attracted because operated in wavelength near 1.55 micro meters. Deployment of EDFA led to light wave system capacity exceeding 1TB/S. In this paper, we analyze the gain and performance analysis of EDFA.

[1] In this, studied the performance characteristic of EDFA operating in c band and pumped at 980nm simulated: Gain and noise figure variation were obtained as function of fiber length, pump power, signal input power and erbium doping density in high bit rate 10Gbps. Gain varies along the fiber length because of pump power variation. For a given pump power the amplifier gain increase up to a certain length of fiber and then begins to decrease after a maximum point. The variation of gain with pump power for different fiber length (10,30,50)m. It has been observe that the EDFA sharply increase with the increasing pump power. And for the erbium ion density, it is seen that for sufficiently pump power, the gain linearly increase with increasing erbium ion density and remain constant after a certain level then decrease. Now for the noise figure, for a pump power of 10 mw the increase in noise figure from 8m can be clearly noticed.

The reason for this increase is the decreasing gain with sharp pump depletion. [2]In this investigate the 1555nm high power fiber amplifier with different length of gain fiber, a two-stage hybrid fiber amplifier structure was employed .it comprises an EDFA as a pre-amplifier and an erbium/ytterbium co-doped double cladding fiber amplifier (EYCDFA).The successful development of EDFA greatly promoted the development of the all-optical communication network in the 1980s.The superior traits of high gain, good noise feature, and high transmission rate make EDFA become the key part in the communication system particularly, the 1550nm wavelength line is attractive for many potential applications. Such as atmosphere laser communication, CATV systems and medicine etc. The output power of 1550nm-band high power fiber amplifier can be promoted by the appearance of EYCDFA because of co-doped Yb3+ ions can suppress the concentration quench phenomenon. These two kinds of ions with similar radius and low solubility can form the ion clusters. More Yb3+ ions around Er3+ ions can reduce the action among them which cut down the up-conversion probability and makes higher ion conversion. [3] In this we analyze gain verses pump power for EDFA. The RUNGE-KUTTA method with fourth order accuracy is the method used to calculate the input pump power and gain for EDFA. And compare the theoretical result with experimental characterization for gain versus pump power. Also present the analytical method to calculate EDFA gain as a function of input pump power. Using EDFA in optical network is possible to extend transmission distance and the capacity in optical network also EDFA has a large bandwidth and low noise figure. In these cases to analyze the optical parameter, we use the dynamics of EDFA with the numerical method based on RUNGE-KUTTA method with fourth accuracy.

The EDFA is modeled with a set of three differential equation as a three level laser system. These differential equations from EDFA can be modeled with a numerical model, which describe the EDFA dynamics and require to determine the gain and loss spectra. RUNGA-KUTTA method provide the best solution for these differential equations form EDFA, because the RUNGE-KUTTA method approximate the very well solution and provide low errors.[4] In that we analyze fiber transmission penalties due to EDFA gain transient in a chain of 10-20 EDFA with as many as 32 wavelength-division-multiplexed channel. Penalties are a result of increase fiber non-linearity during channel deletion and amplified spontaneous emission noise during channel addition. From the study we find that the system performance is severely degraded both in single mode fiber and dispersion shifted fiber due to fiber non-linearity, the signal to noise ration can be reduce by up to 8db in a 32 channel system, a control channel to suppress EDFA gain and SNR transient may impose an additional penalties which increase with

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the bit rate. Given N-1 add-drop channel in an N channel system, we find that ,the power increases due to channel dropping severally degrades the performance of the surviving channel because of self phase modulation channel adding degrades all the channel due to cross phase modulation and four wave mixing for up to few microsecond ,the SNR can be reduce up to 8db in a 32- channel system [5] In this paper multistage EDFA has been design to achieve higher gain with low noise figure. This paper represents all possible triple pass EDFA configuration performance of all the configuration has been analysed with the pump power ratio, signal power. optimum length and optimum pump power ratio has also been determine for each and every configuration from the performance best tripple pass EDFA has been recommended for practical design the basic of EDFA are one stage single pass EDFA (SP EDFA) and one stage double pass EDFA (DP EDFA). By connecting these two basic configurations serially it is possible to obtain multi stage EDFA. Triple pass EDFA (TP1 EDFA) can be design in many ways one single pass and one doule pass EDFA configuration. The output signal power of the first single pass EDF is the input signal power for the second double pass EDFA. Both EDF have the same property optimum length for all TP EDFA has been calculated. From the obtained result, it can be said that TP1 EDFA will be the best for practical design.[6]In that model an EDFA configure in dual stage(DS) scheme with tunable band pass (TBP) is presented. a circulator is used to reflect the amplified signal back to EDF and which is incorporated with Tunable band pass filter which filter out amplified spontaneous emission in order to ensure efficient amplification of the signal as it propagate along the fiber. LASER diode operating at 1480nm with 10mw and 220mw are using to pump the double stage. Design parameter of the EDFA are optimised using the numerical simulation of EDFA rate equation model in order to optimised the performance of EDFA. From the observation it has been seem that NF show a constant behaviour with increasing of pump power. This can be demonstrated in terms of the relation between noise figure and pump power, which may be influence of the filter that locks the ASE. As a result, noise figure locks at to a fixed value. the lowest value of NF was recorded 7db at -50dbm and highest value 12dbm.The noise figure was unaffected by the pump power which was increase from 10 to 220mw.[7]

In this study we analysed the basic effect of EDFA with a wide gain range and a small noise figure(NF) variation is analysed. The Erbium ion may be excited by a number of optical frequency ,the shorter wavelength excite the erbium ion to the highest possible energy level. The EDFA has been configuration in two ways ,one stage EDFA, it mean only one stage EDF that work in an active area. The one stage can be a single pass or double pass. The basic single pass comprises one or two pump laser diode with fiber output, and one or two WDM to collect the light with pump power. The double pass is a stage in which signal will pass two times in active medium the EDF. It has been proven that double pass method will enhance gain twice as compared to single pass .in this study we observe that initially gain was 10db and noise figure was 11.5db but after increasing gain the noise figure become 6.1db form 11.5db.

II CONCLUSION

In this paper we analysed and study the variation of gain or output power as a function on input power or optical length the analysis is done various input power and various input length and we analysed the output as a function of gain and noise figure. from the result we observe that gain upto 35db when the noise figure was 6.1db.in this I will try to increase gain so that noise figure as much as decrease and the optimum value of fiber length is calculated in optimum output power so that gain value is increase as much as possible.

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