Design and Analysis of Erbium Doped Fiber Amplifier for Optical Communication Network

Raya Majid Alsharfa

1Electrical Technical College, Middle Technical University, Baghdad, Iraq

Abstract. Optical system that be valid wave-length division multiplexing (WDM) is by and by extensively utilized in present media communications structures and is assessed to have an imperative influence in cutting edge schemes and the future Internet supporting a substantial decent variety of administrations having extremely assorted necessities as far as transfer speed, idleness, unwavering quality and different highlights. The main decision of this paper is to execute Erbium Doped Fiber Amplifier (EDFA) in the scope of C-band. The gain and commotion figure at every variety of both length and siphon control are exploratory, reenacted by utilizing Matlab programming. The EDFA optical intensifier is presented in the Wave-length Division Multiplexing (WDM) plan to trigger in various contributions at various wavelength in the range between 1538 to 1565nm.

Keywords: fiber length, gain, noise figure, pump power, C-band, EDFA, WDM.

1. Introduction

One diverse normal for an optical fiber is that there is a broad ghostly area where signals are transmitted in optical fiber. In the interim most prominent light sources utilized in high-limit optical correspondence plans to transmit restricted wavelength or under 1nm, though most prominent full-range filaments for correspondence application enact in C-band [1-5]. Wave-length-division multiplexing (WDM) is a process that have the capacity to utilize huge optoelectronic transmission capacity difference, which is each end-o work just at electronic rate, however various WDM channels from assorted end-clients may be multiplexed on the comparative fiber. Single have capacity to take advantage of the tremendous fiber data transfer capacity when various WDM channels convenience on a solitary fiber. In the interim all parts in a WDM gadget essential to work at electronic circuit speed for the greatest part, it is less demanding to execute any WDM gadgets. In this way, various WDM gadgets are possible in the commercial center these days, and extra are creating [6-8]. EDFA can be defined as optical intensifier be utilizes a doped optical fiber to increase average to enhance optical flag. The flag which is to remain enhanced and a siphon laser are multiplexed keen on the doped fiber, also the flag is intensified done collaboration with the doping particles .EDFA is the best frequently utilized as speaker inferable from low misfortune optical window based fiber. EDFA too consume vast gain transfer speed, which is generally several parameters and it is extra from adequate to enhance information channels with the most noteworthy information rates deprived of current any impacts of increase contraction EDFA increase smoothed is huge in whole deal multi-channel light wave transmission plans Optical Fiber intensifier is vital allowing innovation for rapid optical correspondence [9-11]. Normally, EDFA is appropriate to operate in C-band from about 1530nm-1565nm. This amplifier
permits immediate amplification of multiple wavelengths over 1.5μm wavelength area; these are exciting because they offer long haul communication over fiber networks. These optical amplifiers are advanced after the original work on fiber laser and study on rare earth doped fiber. The diverse kinds of rare earth doped material [12, 13]. The optical fiber amplifier permitted the amplification of signal in optical domain, here is no essential to change the signal optical into signal electrical. Er3+ ions have the optical fluorescent possessions that they are appropriate for optical amplification. EDFA permits the optical signal to be amplified straight in the high bit rate schemes. A main concern with using wavelength division multiplexed (WDM) schemes is the non-uniform gain over the 1550nm window [14, 15]. Diverse wave-length signals involvement diverse gain and so different signal to noise ratio. Thus, it is significant to recompense for this non-uniform gain spectrum over the 1.5μm window [16].

2. Erbium Doped Fiber Amplifier for C-band
A similarly important light statement is shifted by the data indication by a wave-length fastidious coupler. The information flag and an agitation, light need remain at definitively opposing wave-lengths. The fluctuated light is coordinated curving on a unit of fiber with erbium subdivisions contained in the center. The influential light shaft rejuvenates the erbium subdivisions to higher-vitality national. At the point when the photons fitting to the flag at a divergent wavelength from the siphon light observe the animated erbium subdivisions, the erbium iotas stretch active a few of their vitality to the flag and return to their lower-vitality state. An essential supposed is that the erbium stretches up its vitality as added photons are definitely for comparable stage and heading as the flag being intensified. In this way the flag is enhanced end to end its method for compact solitary [9]. This isn't phenomenal - when a molecule "lases" it persistently stretches up its vitality in the comparative way and stage as the got light. Thusly completely of the additional flag control is directed in the comparable fiber mode by way of the got signal [17]. Here is normally an isolator located at the harvest to maintain a strategic distance from proliferations repeating from the submitted fiber. Such reflections bother enhancer process and in the energizing circumstance have the capacity to reason the speaker to build up a laser. To appraise the suggested gain-clipped C-band EDFA, a model, as showed in Figure 1 [17] was once arrangement the usage of Opti System. In that circumstance, a C-band EDFA used to be gathered by way of a spread on 10-m EDF then a 980 nm 250 mW siphoning mild wave, yet twain optical isolators had been extra among both side concerning the EDFA in conformity with impede every reflected mild wave. The gain-clipping trademark was once attained by applying an optical splitter, a melodious OBPF and an optical combiner after circle again part on the EDFA harvest ASE clamor. To examine the suggestion, a jubilee mild bud manufactured out of a tunable laser (TL) was once sustained into the gain-clinched EDFA and its access was exploratory via an optical spread analyzer (OSA). In bearing in imitation of seem to be at the association in a circle backdrop bar suspense rank widths, the EDFA gain, NF and enhancement consistency, the OBPF pass-band used to be ordi- nary after 1538 in accordance with 1565nm which is organized at the almost striking government rate on the ASE commotion, yet the pass-band switch velocity (OBPF-BW) was attuned from 1 GHz in conformity with 10 GHz. The upgraded OBPF-BW honor used to be earlier than trying according to consist of the endorsed C-band EDFA.

Figure 1. Erbium Doped Fiber Amplifier for C-band [17]
3. Simulation and Results

In looking at and conspiring optical system there are various methodologies have the capacity to be utilized in EDFA gain enhancement, for WDM (Wave-length Division Multiplexer) plot optical system, utilized reenactment strategy to some degree from development approaches. Test system licenses architects to plan the most exact and capable structure before the genuine optical system constructed. Moreover, skilled to find the characteristics of extra plan denied of physically shape it. Likewise, by MATLAB reproduction procedure engineers are fit to training troublesome that occur through planning the optical system. Prior begins to plan, basic to perceive the best test systems programming that is fitting to structure this optical system. Figure 2. Clarify EDFA anticipated gain versus input optical power when flag wave-length = 1550 nm When Pump Wave-length = 980 nm Pump Power = 40 mW. Figure 3. EDFA anticipated ASE control versus input optical power and flag wavelength = 1550 nm When Pump Wave-length = 980 nm Pump Power = 40 mW. Figure 4. EDFA anticipated gain versus input siphon power and wavelength = 980 nm the Signal Wavelength = 1550 nm Signal Power = 50 uW. Figure 5. EDFA anticipated ASE control against input siphon power and wave-length = 980 nm the Signal Wavelength = 1550 nm Signal Power = 50 uW.

Figure 2. EDFA predicted gain vs. input optical power when signal wave-length = 1550 nm When Pump Power = 40 mW. Pump Wave-length = 980 nm.

Figure 3. EDFA estimated ASE power vs. input optical rule or sign wave = 1550 nm When Pump Power = 40 mW Pump Wave-length = 980 nm durability.
By partner the result from the reenactment, it sit-downs that advanced siphon power determination convey higher gain yet conversely as far as uproar figure. The most extreme gain has the capacity to be achieved at the greatest siphon control minimum clamor figure. For the introduction siphon control given, there happens an adjusting input flag control with which the power result is least. This base power result connotes the ideal exchange off at the lower flag control. The power result assigns the dissimilar highlights at disparate siphon control. At lower siphon control, the power outcome is further touchy to the flag control. At that point the plan would be worked at a higher siphon control for accepting a broad sole prospect of information control for getting a broad influential scope of the information flag control.

Intensified Spontaneous Emission: Amplified Spontaneous Emission (ASE) is unique of the primary premise of clamor that occur in the speaker. Through the light outflow in invigorated

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**Figure 4.** EDFA predicted gain vs. input pump power and wavelength = 980 nm Signal Power = 50 uW when Signal Wavelength = 1550 nm.

**Figure 5.** EDFA predicted ASE power vs. input pump power and wavelength = 980 nm Signal Power = 50 uW when Signal Wavelength = 1550 nm.
emanation, there are two states happen by the particles transmit the photon vitality the comparable wavelength with the information flag or the iotas return to the lower vitality discretionarily and create commotion as perceived as ASE. The yield in ASE is looked on OSA.

4. Conclusion
For case the input signals power, higher the input signal power lead to higher gain presentation. Though for power pump, higher the pump power resultant higher the gain presentation. Disobediently, the gain is reduced at the confident level when the population transposal is delivered for wholly erbium ion in the fiber too amplifier drives saturated. Therefore, the ideas of the scheme are positively satisfied.

Though, here are many approvals that essential to be highlighted for gain development to certify that there are further invention and development for improved requests in the future. Present is a lot satisfied.

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