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Design of WDM PON network using different EDFA

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ABSTRACT

This paper proposed the wave division multiplexing passive optical network. In this design we utilize the array waveguide grating AWG in place of WDM due its cyclic properties. An EDFA with forward pumping in downstream and backward pumping is used in up streaming .Performance of design is analyzed with variation in length of fiber and it is seen the performance is better than the existing WDM PON analyzed.

Keywords: Optical communication, Wave division multiplexing, Passive optical network, Erbium doped fiber amplifier.

• INTRODUCTION

During the long distance communication of signal in the optical fiber suffers from various types of losses like fiber attenuation losses, fiber tap losses, fiber splice losses, etc., make the more attenuated signal at the receiver side. So for transmitting the signal over the long distance fiber optic cable there is need of the power compensating system at every few km of fiber so all losses compensated [1-3]. A optical amplifier like the electrical amplifier operates in the optical domain so it amplifies the optical signal directly in the optical domain. There are mainly two types of optical amplifiers: semiconductor optical amplifier and fiber amplifiers. Fiber amplifiers are classified as an erbium doped fiber amplifier (EDFA), Raman amplifier and Brillouin amplifier.

EDFA is constructed by a popular material for long–haul telecommunication applications that is a silica fiber doped with erbium (Er+3) ions [3,4]. Er+3 ions, related the optical fluorescent properties that are suitable for the optical amplification in the optical domain. The EDFA operates to amplifying the high data rate signal up to the Terabits. One of the most important factors limiting the transmission distance in fiber optical communication systems is the optical power loss. The losses occur due to the scattering and absorption mechanisms in optical fiber [5-7]. EDFA is most suitable to use in the conventional (C) band from about 1530 to 1565 nm. Since the entire C band of EDFA is fully used. EDFA has a very low-gain for L-band. For realizations of L band EDFA is implementing a long length of erbium-doped fiber (EDF) to pump up its gain at 1480nm and 980 A typical L-band EDFA has a larger noise figure than C-band EDFA. Normal pumping frequency used for EDFA is 980nm and 1480nm.this design is implemented by EDFA.section 2 of the paper explain proposed design . Section 3 explains the result and analysis and paper end with the conclusion at last.

• PROPOSED WORK

Wave division multiplex based Passive optical network is designed as shown in figure 1.This is implemented with Array wave guide gratin due to its cycles properties. The downstream wavelength range is 1530-1560nm and upstream range is 1310-1340nm. The Erabum doped fiber amplifier (EDFA) is inserted in the bidirectional fiber cable for downstream and upstream direction. The pump power in forward and backward is arranged to enhance the performance of the design. Passive optical network contains the optical line terminal at the transmitter end and optical network unit (ONU) contains the transmitter for upstream and receiver for downstream. Array wave guide grating (AWG) work like a remote node. Design is analysis for 0.8nm WDM system and data rates of downstream and upstream is kept at the 5Gbits/s.

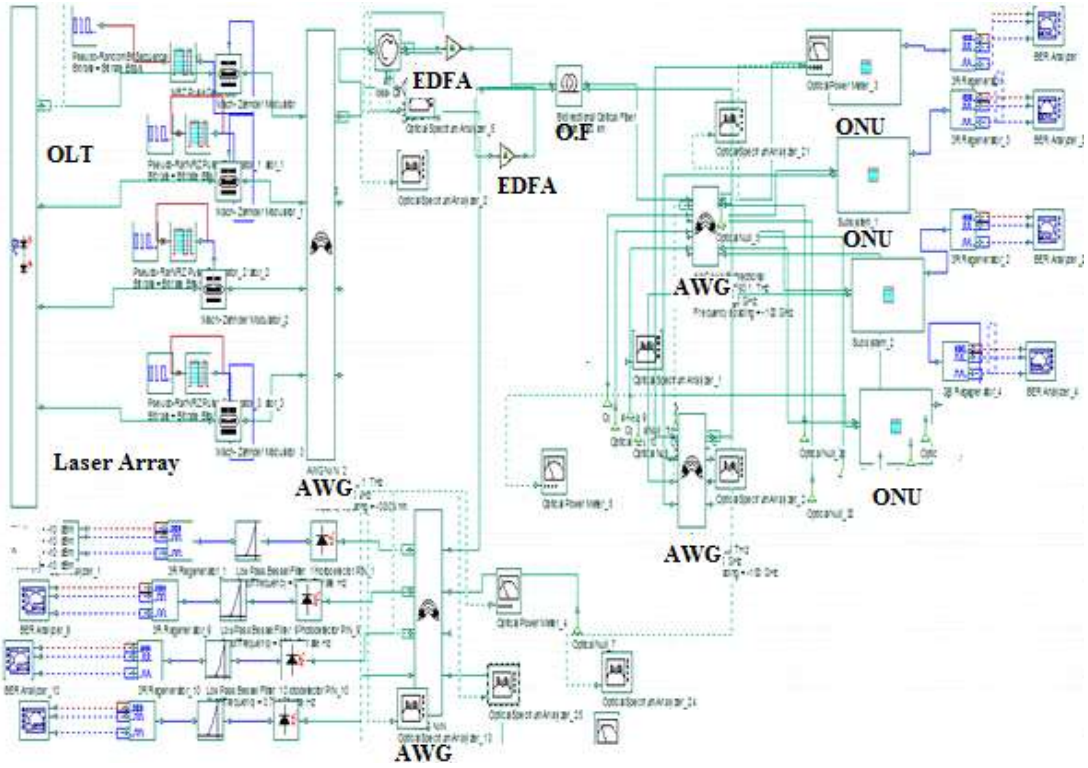

Figure 1: WDM PON network using AWG

- **RESULT AND ANALYSIS**

Fig.2 shows the variation in BER in length of fiber with the use of EDFA amplifier of 5Gbits/s and it is seen that performance is better than the present WDM PON network. The forward pump power is 10mw and backward is also 10mw.

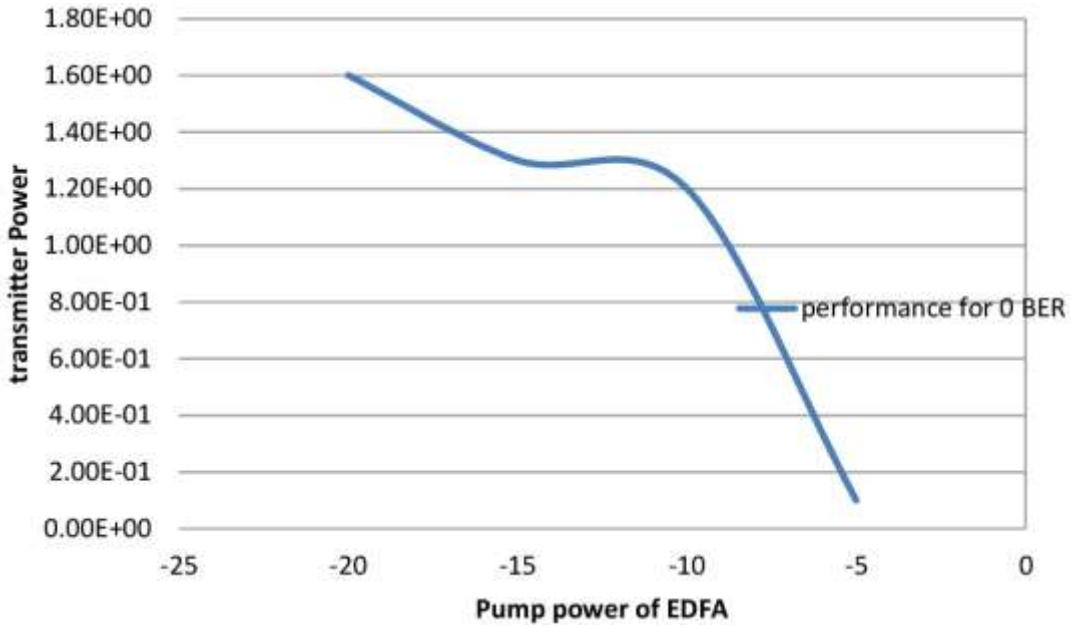

Fig. 2: variation in BER with length of fiber with EDFA in DS and UP

Fig.3 gives the performance of BER with the forward pump power with the constant backward power of upstream at 40km of length of fiber and 5Gbits/s data rates.it is seen that the variation is nearly linear.

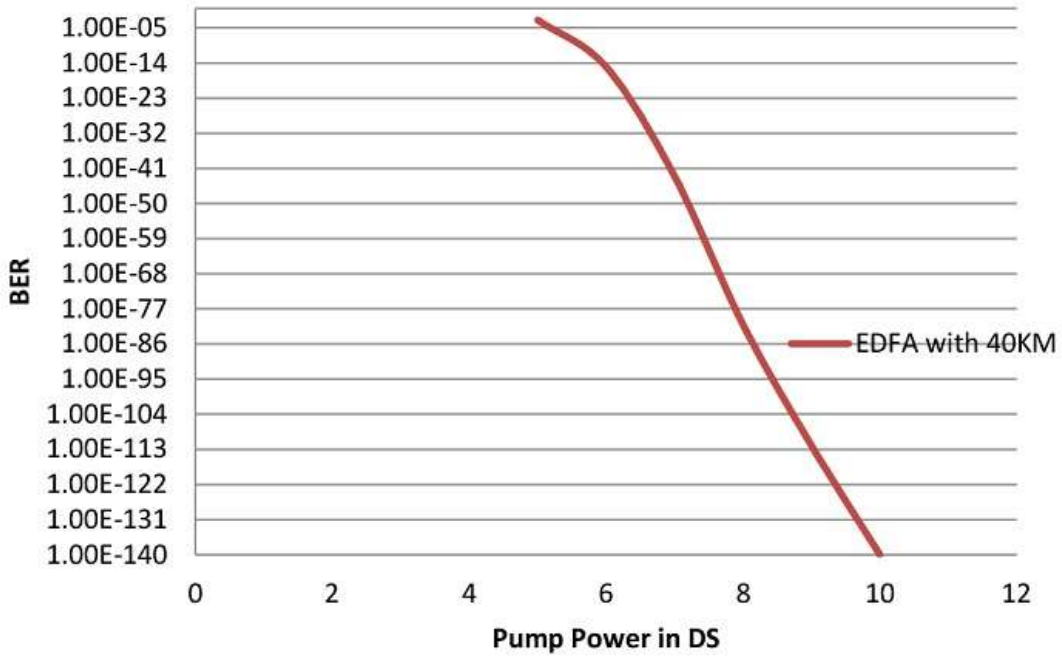

Figure 3: Variation in BER with pump power at 40km with 5Gbits/s data rate

Fig.4 gives the relation of transmitter power and their corresponding minimum pump power for required BER of optical communication at 60 km for the upstream direction at 5Gbits/s.

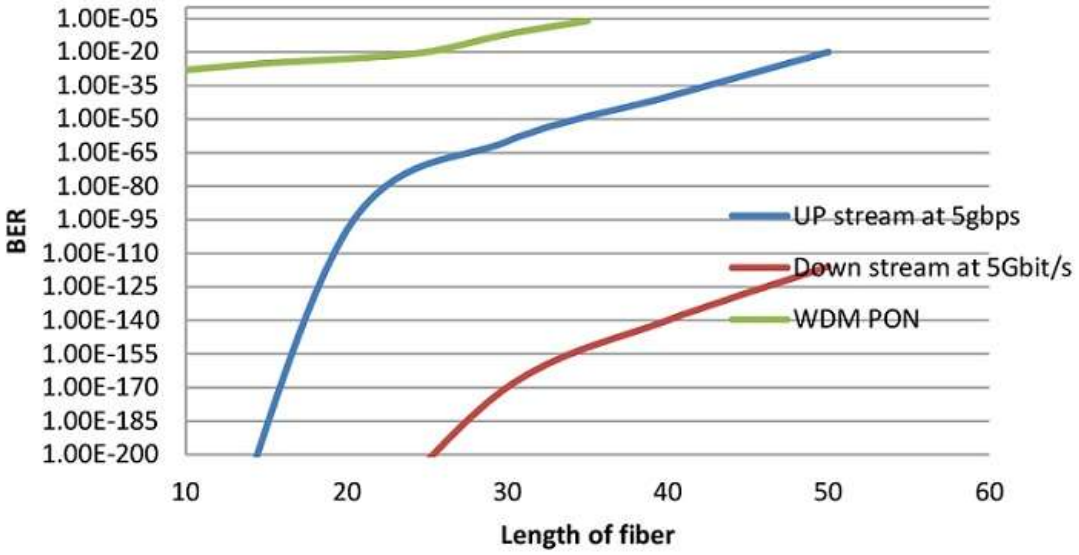

Fig. 4: relation with transmitter power to Pump power

The spacing between the laser pulses is kept at 0.8nm in all cases. The simulation is done in a practical environment in all, with all nonlinear effect is kept on. Simulation is performed for the fiber with ITU standard single mode fiber (SMF). Dispersion of SMF is 17ps/nm km Decoder side after decoding the signal, the signal covert to electrical by passing to the photo detector and 0.75 GHz low pass Bessel filter (LPF) The dark current value was 5 nA, and the thermal noise coefficient was 1.8 x10–23 W/Hz for each of the photo-detectors.

- **CONCLUSION**

This paper proposed the design of WDM PON system using the Array waveguide gating The cyclic properties of AWG is utilize in place of WDM MUX in designing of PON networks. Simulations show the enhanced performance with the combination of EDFA amplifier in design of Passive optical network. The pumping frequency of EDFA is 980nm in the forward and backward direction for downstream and upstream direction. All simulation is done at the 5Gbits/s and length of fiber is 40km.

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