Modified DPSK Transmission System with Hybrid Bandpass Filter (HBF)

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Abstract-*Optical filters are the components which are used in the both transmitter and receiver section of the communication system. Here I proposed an optical Hybrid bandpass filter (HBF) in bidirectional DPSK transmission system by replacing an Erbium doped fiber amplifier. When the data is transmitted the problem is loss of data or increase in bit error rate. In order to circumvent this problem, an alternative solution is achieved by using the hybrid band pass filter. The proposed optical bandpass filter can continuously change its optical bandwidth by using a tuneable filter. Optical bandpass filters are commonly used in especially in long-haul dense wavelength division multiplexing (DWDM) systems where signal bandwidths need to be managed tightly, the characteristics of optical filters are critical to achieve high spectral efficiency and to increase the total information capacity. It is also known that optical filtering can improve the performance of single-channel optical communication systems by mitigating the effect of polarization mode dispersion and chromatic dispersion. In this research work a modified DPSK system using Hybrid bandpass filter is designed and simulated using Matlab software. The signal is amplified with feedback gain of 10 GB/s. The bit error rate tester is used to analyze the signal followed by an EDFA. Now the signal becomes without any distortion and to propagate in the optical fiber at long distance.*

Keywords *– Bi-directional DPSK, Interleavers, Hybrid band pass filter (HBF).*

1. INTRODUCTION

Lot of research have been done in the field of optical fiber communication and vast variety of filters has been implemented so far, but there is still a need to improve the quality of data transmission. The Bit Error Rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission [2]. The Hybrid bandpass filter (HBF) an external modulator which is used to modulate a beam of light. The beam may be carried over free space, or propagated through an optical waveguide. This basic design proves useful in a fiber optic system. The external modulator has a single optical input of polarization maintaining (PM) fiber and a single optical output of PM or single-mode (SM) fiber. In a simple external modulator, two electrodes surround the waveguide [7]. The bottom electrode is grounded while the top electrode is driven by an outside voltage signal. As the voltage on the top electrode changes, the refractive index of the waveguide changes accordingly, alternating the light as the refractive index rises and falls. While this modulates the phase of the light, the output intensity remains unchanged. The output of external modulator is applied to optical filter in long-haul dense wavelength division multiplexing (DWDM) systems where signal bandwidths need to be managed tightly, the characteristics of optical filters are critical to achieve high spectral efficiency and to increase the total information capacity [1]. It is also known that optical filtering can improve the performance of single-channel optical communication systems by mitigating the effect of polarization mode dispersion and chromatic dispersion [6]. The output of optical filter is given to EDFA to reduce the noise coefficients and to increase the signal transmission and after signal is transferred to bit error rate tester.

2. PROPOSED ALGORITHM

All Selective call radio algorithms are used in this Modified DPSK Transmission System. This algorithm describes how operation is performed in this system. The steps used in this algorithm are:

Step 1: Variable declaration

Zero padding has been Round toward nearest integer to the value assigned to it. Total constellation points and total symbols have been taken as 16 and 20 respectively. Total symbols as per length of fft is calculated by the multiplication of total number of symbols and length of fft. Defined variable P num upto the length of 'total num symbols' is initially defined as zero and then value of 10000 upto the length of total num symbols is defined.

Step 2: Filter and file operation

Length of Bessel filter is defined as 23.Complex half band filter upto the length of Bessel filter and guard interval with rows=20 and column=320 are initially defined as zero. HBF23.txt'file is opened and read using fscanf with format %f and then file is closed. High boost filter and hp filter for smoothing purpose are initially defined as zero upto the length of Bessel filter. Then High boost filter and hp filter are defined as zero up to the length of 12800.

Step 3: File section

Different text files are opened and read using fscan for inphase and quadrature phase variables.

Step 4: Window Function

Initially Zeros are defined upto the Length of 320.Hamming window operation is applied up to the length of variables as defined (length_fft+1) : (length_fft+Ng).Again text files are opened and read

Step 5: Bits mapping to constellations

Initially I is taken up to length of 5120.The variable inphase is mapped on data_I_train_word_re_i0_256.txt. And variable quadrature phase is mapped on the text file data_Q_train_word_re_i0_256.txt .Similarly other inphase and quadrature phase variables are mapped on data_I_train_word_1_i0_256.txt.

Step 6: Guard interval insertion

The output of variable 'IFFT_out_in_quad'for rows (ig) and coloum (1:length_fft) are stored in the variable guard_int_out whose values are specified in rows as variable and coloums as number_zeros, 'Ng+number_zeros+1:(Ng+length_fft+number_zeros')

Step 7: Sample rate and modulation

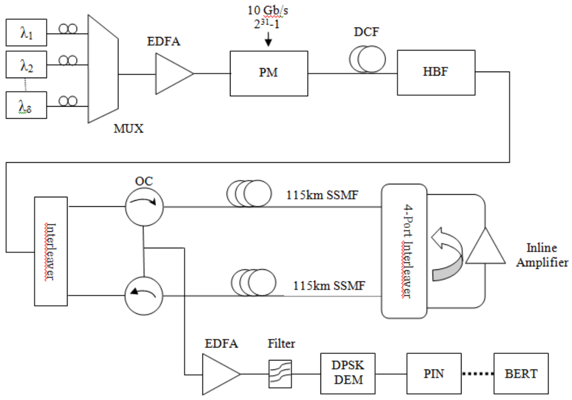
The output of High boost filter is specified using the operation 2*high_boost_filter_in*complex_hb_filter'. Inphase and quadrature phase Modulation is performed for the length of high boost filter out.Finally received data is write on the text files named:out_inphase_4_BF.txt and Sout_inphase_4_IF.txt

Step 9: Figure plots

Figures are plotted.

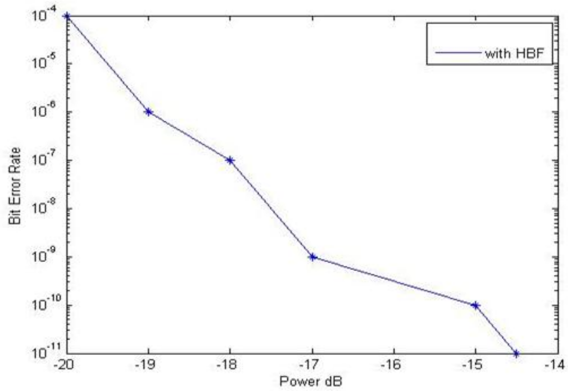
3. Modified DPSK with HBF

In this research paper, I proposed a modified dispersion-free interleaver using optical delay lines by accurately locating the zeros in the transfer function. It has been implemented with the design of interleaver pairs with the same amplitude responses but opposite phase responses for bidirectional dense wavelength-division multiplexed (DWDM) transmission systems. The measured results are consistent with literature results [3]. The further modified the original three-port design using unidirectional amplification and a Hybrid bandpass filter followed by a four port interleaver as shown in figure has been built and demonstrated to achieve return-to-zero differential phase-shift keying (DPSK) modulation formats for 230 km of transmission. I fully studied and verified the applications of hybrid bandpass filter in bidirectional transmission [5]. I demonstrated a bidirectional strain-line system over 230 km to reduce bit error rate using 10-Gb/s bit error rate tester. Furthermore, I also demonstrated return-to-zero differential phase-shift keying (DPSK) modulation formats for more than 230 km of transmission.



Bidirectional DPSK transmission system with modified filter

For comparison, the different amplification functions. The simulated results have clearly illustrated the desirable functions of this modified Hybrid bandpass filter (HBF) in this dispersion-free interleaver bidirectional DPSK transmission system [1]. In DPSK transmission system still there was loss of data, they are focusing on interleavers and EDFA amplifiers to achieve the signal with minimum error in bits. So I found that there is still need to improve bit error rate with systematic approach, so I implemented hybrid band pass filter.

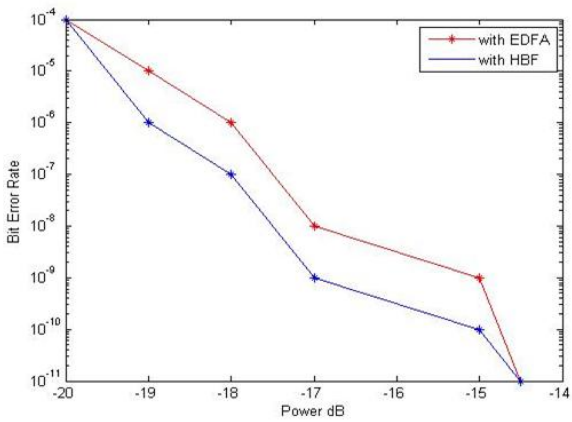


Bit error rate versus received power plot for DPSK Transmission system using (HBF)

We can see that the Bit error rate BER= 10^{-10} or less for channel (λ=1559.39 nm) which clearly indicates the good quality of the signals after 230-km fiber at received power is about -15 db with the implementation of HBF in our research work, which is fulfil our requirement.

4. RESULTS

The simulated results on 230-km long standard single mode fiber for modified bi-directional DPSK transmission with hybrid bandpass filter in terms of bit error rate are shown in figure. The graph clearly shows the Bit error rate BER= 10^{-10} or less for channel (λ=1559.39 nm).



Bit error rate versus received power plot for DPSK Transmission system using (HBF) and using (EDFA)

Bit error rate versus received power plots of DPSK with EDFA and modified DPSK transmission system using (HBF) are shown in figure [1]. This graph shows the Bit error rate BER= 10^{-10} or less for at -15 db input power where as BER using EDFA is 10^{-9} for same input power for channel (λ=1559.39 nm) which clearly indicates the superiority of the modified DPSK transmission system using(HBF) as compared to DPSK transmission using (EDFA).

5. CONCLUSION

In this paper, I have demonstrated for the first time an interleaved bi-directional DPSK transmission with 50-GHz spacing that used a four-port interleaver to enable uni-directional amplification. After bi-directional transmission for 230-km SSMF, the power penalties in at channel (λ=1559.39 nm) at BER = 10^{-10} or less than 1.1 dB in RZ-DPSK experiments. Additionally, the differences in receiver sensitivity penalties between bi- and uni-directional transmissions are less than 0.2 dB, it confirms the feasibility of the proposed system configuration. I believed that this bi-directional system can be employed to incorporate more channels in C band, because this hybrid bandpass filter (HBF) with four-port interleaver is designed to cover the whole C band with 50-GHz channel spacing.

6. REFERENCES

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