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BER ANALYSIS OF FREE SPACE OPTICS USING DIFFERENT CHANNELS

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Abstract - *The modern era of communication requires a system providing high bandwidth and channel capacity features. In this paper an effort has been made to analyse BER using different channels-AWGN, Rayleigh and Rician channel. The analysis is studied with the help of MATLAB simulator using simulink. In this model, free space channel is used as a communication channel. The BER is highly affected by atmospheric turbulence. If turbulence is increased, BER is also increased which affect the output at receiver.*

Keyword: *free space optical communication, bit error rate, turbulence.*

1. INTRODUCTION

FSO communication is a technology that transmits optical signal through atmosphere from one place to another. It is a method which establishes point to point communication. As FSO link uses line of sight communication, there should be no obstruction in transmitter and receiver path. High Bandwidth, Immunity to interference Unlicensed spectrum and easy to install are some unique features of FSO.FSO system have attracted attention for applications like last mile connectivity and optical fibre back up. On other hand, performance of free space optics is affected highly by fog and atmospheric turbulence. Atmospheric turbulence leads to increase in bit error rate of the optical link[1].

2. SYSTEM ARCHITECTURE

FSO block diagram consists of source, transmitter, receiver and atmospheric channel.

The source transmits message signal towards the destination. The source signal can be modulated using various modulation techniques e.g. Amplitude modulation, Phase modulation, Frequency modulation Intensity modulation, on off keying. For FSO system the mo widely used techniques is on off keying. After the signal is modulated it is passed to optical source which converts electrical signal into light signal. The light sources that are commonly used in FSO are light emitting diode and laser.

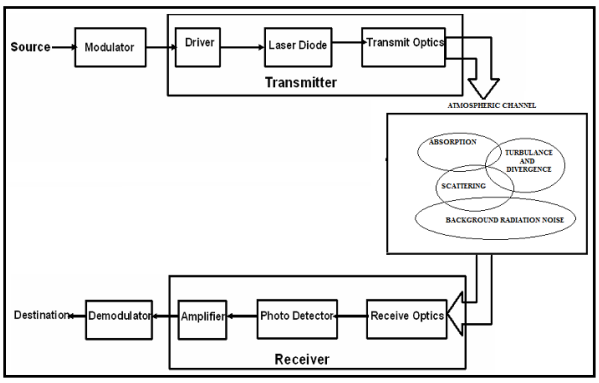

Fig-1: Diagram of FSO Basic Working Model [2]

The receiver basically includes receiver telescope, optical filter and photodetector. The telescope receives the optical radiations and send it to photodetector But before reaching the photodetector they are passed through optical filter which reduces background radiations.

The system architecture of the simulated model contains a basic working model that contains transmitter section, channel modeling and receiver section. In the working initiation, the Bernoulli generator generates the bit signals which is coded by particular data coding system and then the integrated signal is passed through free space channel. The transmitted signal is received by receiver section but the intermittent path shows some dislocation and errors which further displayed by the display installed inside the system.

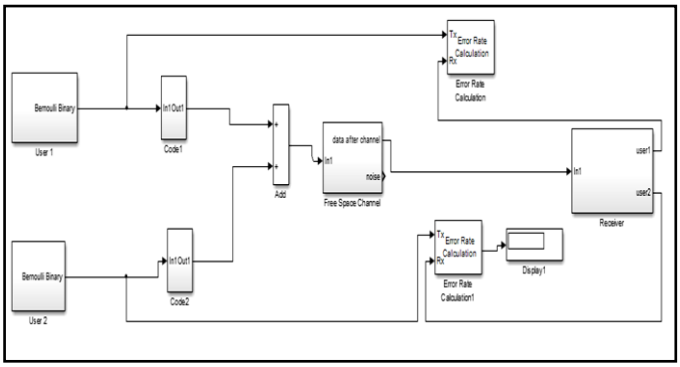

Fig-2: Basic working model

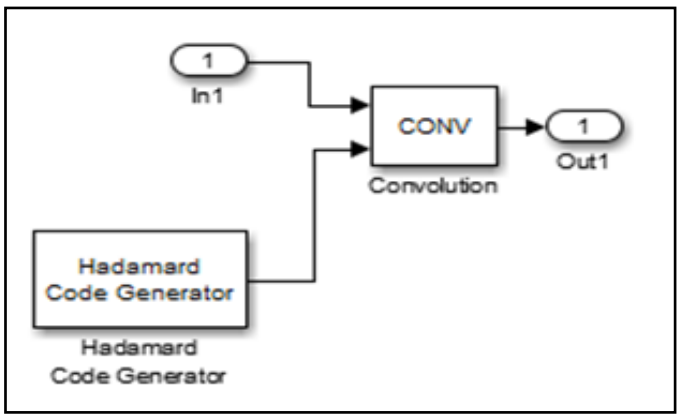

Fig-3: Coding Data Sequence

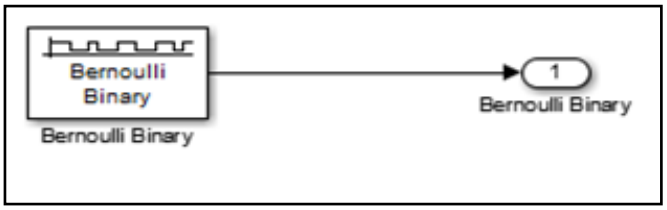

Fig-4: Generation of Random Data sequence

3. PROPOSED MODEL

The simulation model of FSO system is shown on Fig 2. Simulation has been performed in Matlab environment using simulink. The experiment is made by assuming 1000 samples per second. The transmitter of simulation model is shown on Fig. 3. The data sequence for every user is generated by bernaulli generator. This generated data is coded by signature code word. The information signal is summed and send through free space channel.[3]

Hard limiter decreases noise influence to the common information data stream and helps to correctly identify user data.

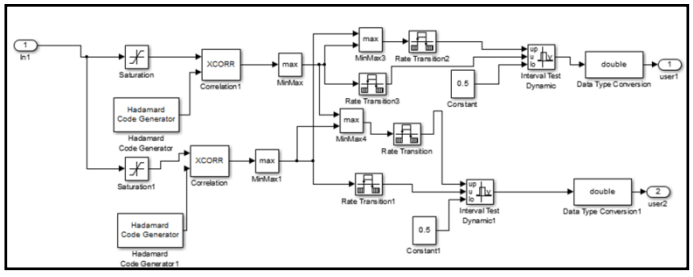

Fig-5: Model of Receiver Section

4. SIMULATION RESULTS

This section of paper discusses the result obtained in simulink of matlab environment. The results are represented in terms of Bit error rate and signal ratio. By varying SNR, with the help of "semilogy" function the graph of BER vs SNR is plotted.

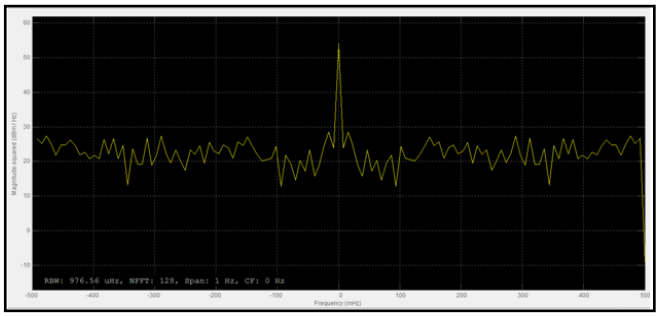

Fig-6: Transmitted signal in frequency domain

Table -1: Simulation Parameters

Parameters	Values
No of samples per second	1000
No. of users	2
NFFT	128
RBW	976.56μHz
K	1
coding	Hadamard coding
Code length	31
SNR	0-20dB
Noise channels	AWGN, Rayleigh and Rician

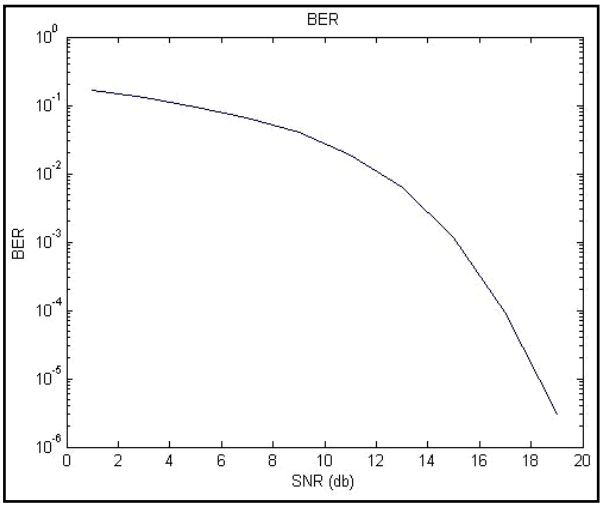

Fig-7: BER Graph for AWGN Channel

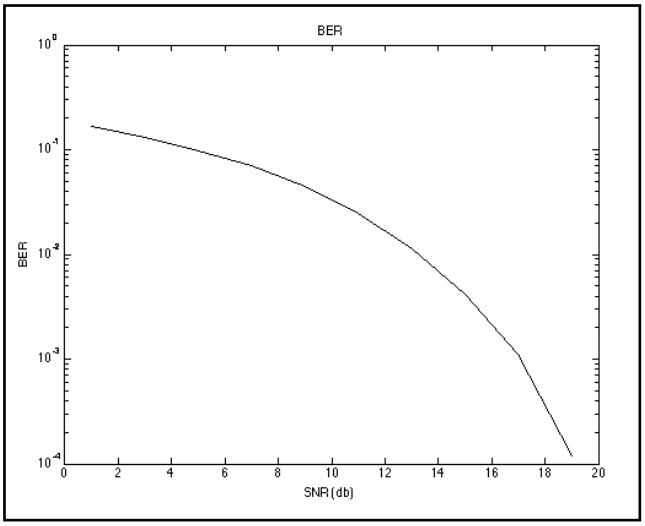

Fig-8: BER Graph for Rayleigh Channel

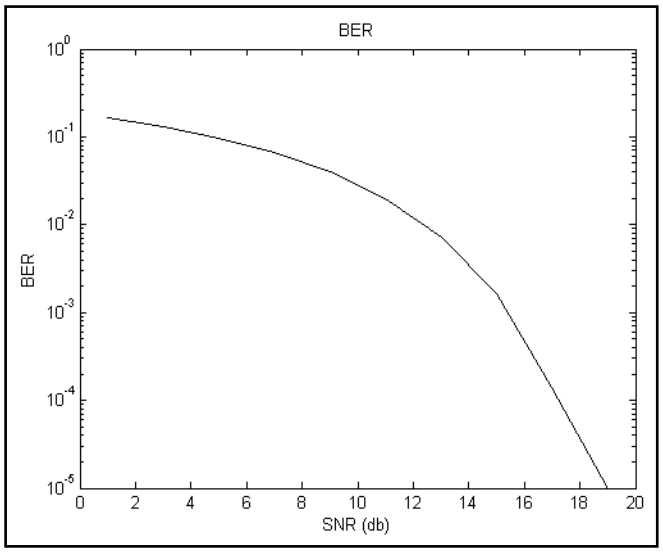

Fig-9: BER for Rician Channel

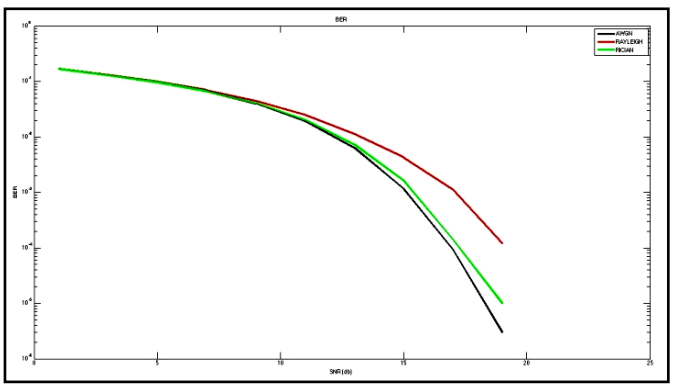

Fig-10: BER performance of AWGN, Rayleigh and Rician Channel

CONCLUSION

We have generated the binary data which is to be transmitted at the rate of 1000 samples per second. The data is encoded using Hadamard code for two users. . The encoded data is passed through free space channel with AWGN or Rayleigh or Rician channel as per model. Then data is being received in receiver where it is decoded and then the received data for both the users is retrieved. Bit error rate analysis is done using received and transmitted data for different levels of noise added in the channel. The comparative analysis of BER by using different channel is considered. The performance of AWGN channel is the best of all the channels as it has BER lower as compared to other channels. The Rayleigh channel has the worst performance as this channel is much affected by noise. The rician channel BER performance lies between AWGN channel and Rayleigh channel.

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