Simulation based comparative analysis of BER using Simulink

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Abstract -

Free space optical communication (FSO) system is sort of wireless communication, often used for digital communication systems due to its low cost and also preferred where the developing the infrastructure is difficult. It provides the security specifically due to its line of sight nature and very small detectable area. As FSO is very sensitive to the specific channel, it offers some serious disadvantages as well. In this research initiation, the impact of free space transfer function on atmospheric turbulence, arousing errors and their path loss factor on the performance of free space optical communication system is presented and its performance in the enclosed free space optical communication system is analysed through Simulink based simulation tool. In the simulation, free space is used as a means of communication channel to evaluate the Bit Error Rate performance of the proposed system.

Key Words: *communication, Channel, infrastructure, signals, transmitter, etc.*

1. INTRODUCTION

Free-space optical communication remains an optical communication technology that employs slight changes in free space to transmit data for applications related to telecommunications and computer networking. In this research initiative, the "Free space" means air, outer space, vacuum, or something similar to that. This contrasts with using solids such as optical fiber cable or an optical transmission line. The technology is quite effective where the physical connections are impractical due to its expensiveness or other considerations. Free-space exact optical links can be installed using infrared or laser light, although low-data-rate based communication over short distances is possible using LEDs. The Infrared Data Association (IrDA) technology is another simplest form of free-space optical communication systems.

Other implications of Free Space Optics are as a communication link between spacecraft. Maximum possible range for terrestrial links is in the order of 2-3km but the efficiency and quality of the link is entirely dependent on atmospheric factors like rain, fog, dusting and ambient heat.

The solely reason behind using FSO as alternative of free space optical (FSO) communication is that it plays a vital role in the development of high-speed telecommunication systems and also offers bandwidth of 105 times greater than the existing Microwave communication. It is also act as an high security, low cost, low power and high rates alternative due to unregulated bandwidth. From above all reasons the FSO communication emerges as a method of transmitting information from one place to another by sending light through the free space through establishing point- to- point communication links through the atmosphere.

In recently published researches, implementation analysis of free space optical communication is investigated without considering all impairments related to atmospheric conditions and related to system parameters which include both external as well as internal features. The above said performance analysis of the free space optical communication system is analyzed through simulink simulator under which the free space is employed as a communication channel during signal transferring.. Through this paper an organized detailing of adequate BER channel is founded and proposed for free space so that adequate free space communication can be established.

2. RELATED WORKS

In the free-space optical communication links, turbulence generates fluctuations in the intensity and the Phase of the received light of signal by impairing link performance. X. Zhu at el. In their research paper discuss several communication techniques to recover turbulence based intensity fluctuations, such as signal fading, transmission lose, etc. In their research work, the use of maximum-likelihood detection is being done in spatial diversity reception in order to reduce the diversity gain penalty resulting due to correlation between the fading at different receivers.

Mr. Hennes HENNIGER and Otakar WILFERT, in their findings, published an overview of the challenges a system designer has to consider while implementing an FSO system.

Xiaoming Zhu at el. presented the Mitigation of Turbulence Induced Scintillation Noise in Free-Space Optical Links through Temporal-Domain Detection Techniques and through real time experiments demonstrate the effectiveness of these techniques in over a half kilometer terrestrial link using ON/OFF switching.

Song Gao, at el. Published in their research findings about a coherent differential phase-shift keying (DPSK) transmission system in order to improve receiver's sensitivity for cordless optical based communication systems. The incoming errors probability expressed over atmospheric channels as it derived under the assumption of log-normal distributed scintillation.

3. SYSTEM ARCHETECTURE

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.

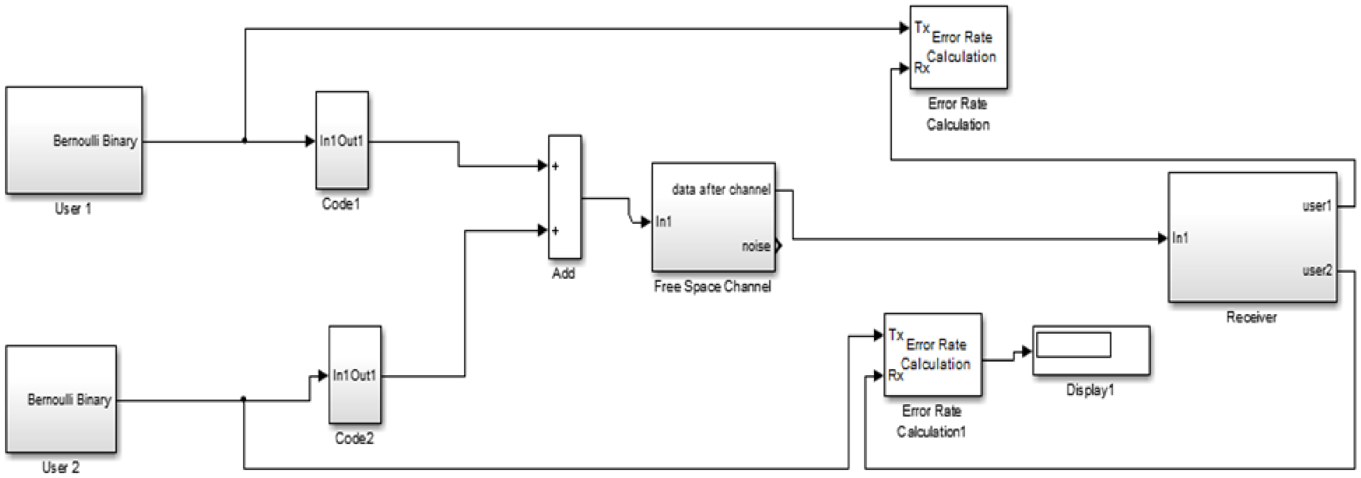


Fig -1: Basic Working Model.

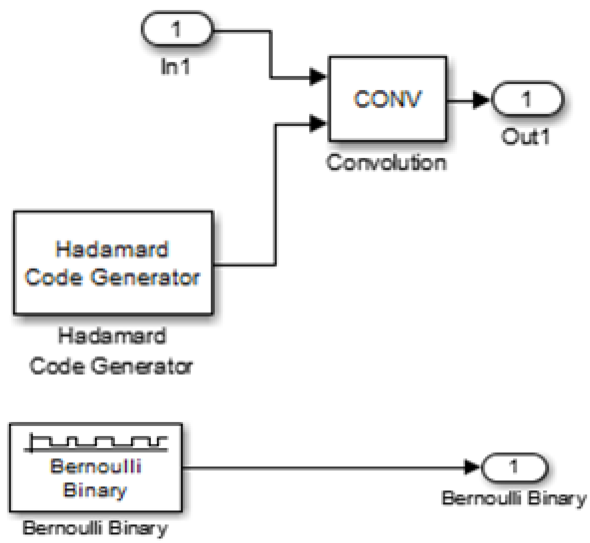


Fig-2: Coding Data Sequence and generation of random data sequence.

4. PROPOSED MODEL

In the proposed system architecture, the data sequence for every user is generated by Bernoulli generator and the generated data is coded by signature code word. The information signal is summed and gets them sent through free space channel. The information signal formed for every user is summed and send through free space communication channel. Then data is being received in receiver where it gets decoded and then the received data for both the users is retrieved using specific methodology. The final Bit error rate analysis is done using received and transmitted data for different levels of noise added in the channel.

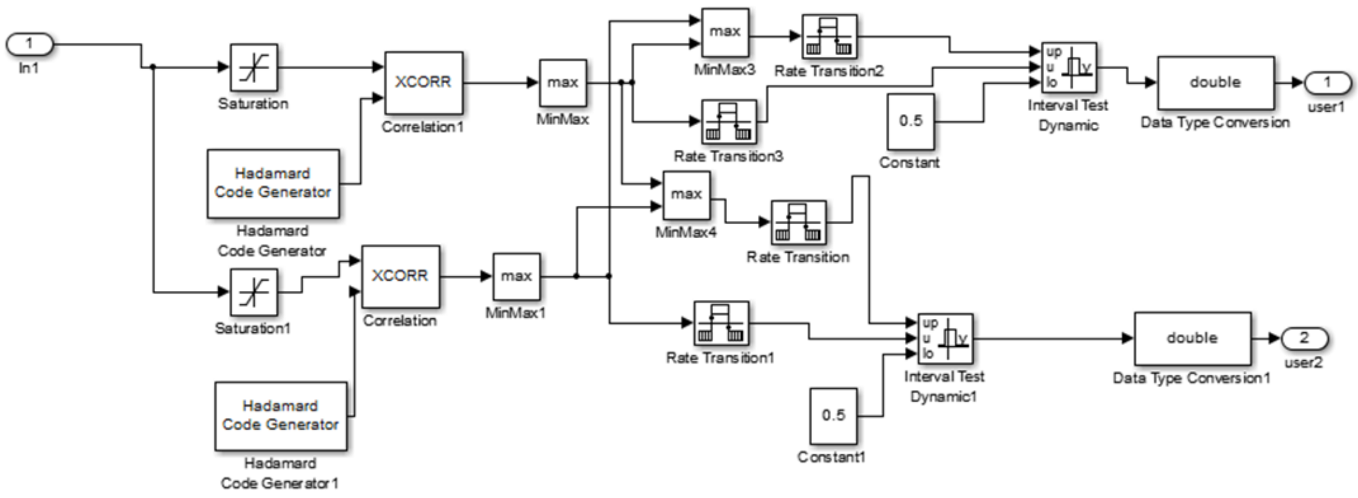
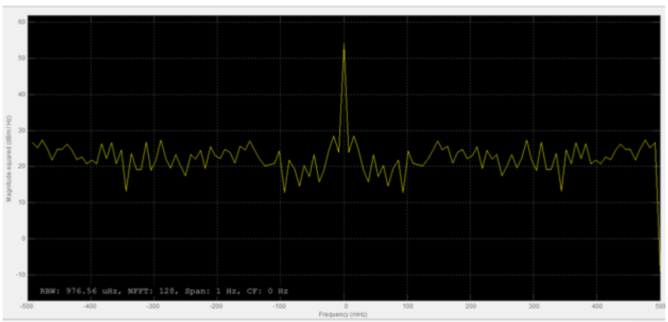


Fig-3: MODEL OF RECEIVER SECTION.



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Graph-1: Transmitted signal in frequency domain.

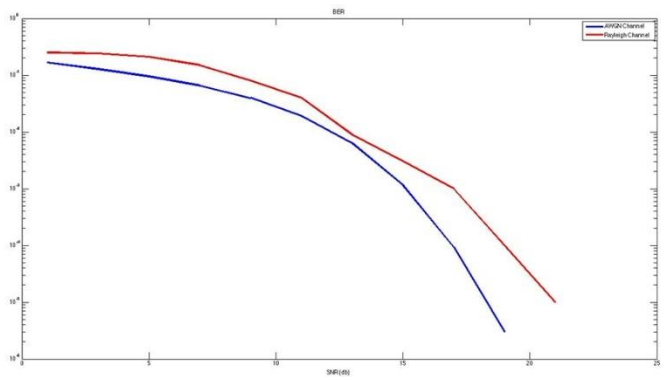

Fig-4: Graphical representation of BER performance of AWGN channel and Rayleigh channel.

5. SIMULATED 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 to noise ratio. By varying SNR ,with the help of "semilogy"function the graph of BER vs SNR is plotted.

Parameters	values
No of bits/sample	1000
No. of users	2
FFT size	128
coding	Hadamard coding
Code length	31
SNR	0-25dB
Noise channels	AWGN,Rayleigh

Fig-5: Tabulation of Simulation Parameters

6. CONCLUSIONS

In this paper we have studied the performance of BER over AWGN and Rayleigh noise channel which are added to our proposed model .From the graph it is concluded that AWGN channel has the lowest bit error rate as compared to Rayleigh fading channel.

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