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PERFORMANCE OF UNDERWATER WIRELESS OPTICAL COMMUNICATION

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ABSTRACT

In this paper, we consider the impact of turbulence on performance of UWOC systems and investigate capacity and bit-error rate (BER) of underwater wireless optical links under weak and strong turbulence by analyzing average capacity, BER, SNR, channel state information (CSI),performance of FSO in SISO and MIMO systems, performance over path gain through the simulation of graphs using MATLAB software. Numerical results suggest that turbulence degrades capacity, BER, SNR, data rate performance as expected. This work provides a theoretical analysis tool for system design and performance evaluation of UWOC systems**.**

Keywords*: Under Water Wireless Optical Communication (UWOC), Bit error rate (BER), Signal to Noise Ratio (SNR), Channel State Information (CSI), Free Space Optics (FSO), Single Input Single Output (SISO), Multiple Input Multiple Output (MIMO).*

INTRODUCTION

In the never-ending search for increased capacity in a wireless communication channel it has been shown that by using MIMO (Multiple Input Multiple Output) system architecture it is possible to increase that capacity substantially. Usually fading is considered as a problem in wireless communication but MIMO channels uses the fading to increase the capacity.

MIMO systems transmits different signals from each transmit element so that the receiving antenna array receives a superposition of all the transmitted signals. All signals are transmitted from all elements once and the receiver solves a linear equation system to demodulate the message. The idea is that since the receiver detects the same signal several times at different positions in space at least one position should not be in a fading dip.

If the transmitter has CSI (Channel State Information) then the transmitter can use the “Water filling technique” to optimize the power allocation between the antenna elements so that an optimal

capacity is achieved. When the CSI is supplied to the transmitter a decrease in spectral efficiency is unavoidable so therefore it is interesting to know in what cases it is important to have CSI and when the benefits are negligible. This will be answered after a series of measurements.

LITERATURE REVIEW

The Free Space Optics (FSO) systems are increasingly being considered as a suitable alternative technology for optical fiber networks, especially in areas where the deployment of optical fiber is not feasible and in underserved rural areas lacking broadband network connectivity. The advantages of FSO communications, depending on deployment scenario and application, including ease of deployment, license-free operation, high transmission security, high bit rat es, full duplex transmission and protocol transparency, Free space optics (FSO) communications gives user a large and unregulated bandwidth. The free space optical system uses the Optical signal which carries the information. This optical signal is not confined into a physical channel like Optical Fiber. In the Free Space Optical communication the optical signal is transmitted into the free space and the air or vacuum space acts as the channel for signal transmission. The FSO can provide data rate in the range of 100 Gbit/s and the data transfer is achievable over a distance of 1-4 km. The direct line of-sight FSO link offer numerous advantages compared to the conventional wired and wireless communications.

EXISTING METHOD

Investigating bit error rate and average capacity in acoustic underwater wireless communication. Acoustic Under water Communication is the wireless communication in which acoustic signals carry digital information through an underwater channel. High bit error rates, Low data rate transmissions are the main drawbacks of acoustic method.

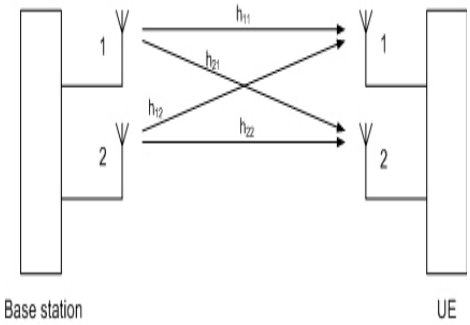
PROPOSED METHOD

Analyzing BER, average capacity, SNR, path gain performance , performance of FSO in MIMO and SISO systems, CSI in under water wireless optical communication under turbulence(UWOC) through the simulation of graphs. With CSI known to the transmitter condition we can increase the throughput rate by using some threshold margin for interference between the transmitted data streams. Optimal MIMO based diversity gain can be included for improved QOS and data rate.

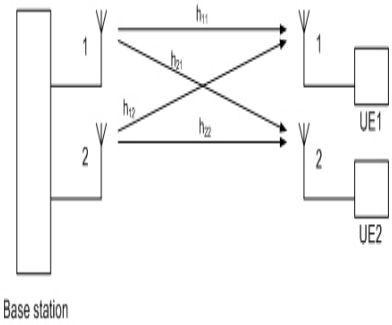
Types of MIMO system

- Single user MIMO

- Multi user MIMO
- Open loop MIMO
- Closed loop MIMO



SINGLE USER MIMO



MULTI USER MIMO

METHODS OR TECHNIQUES USED IN UR PROJECT

COMBINIG TECHNIQUE : In proposed method we sum the signal energy obtained from the both the receiving antenna after finding the erfh of the signal.

TOOLS USED

Matlab software –simulator tool

RESULT

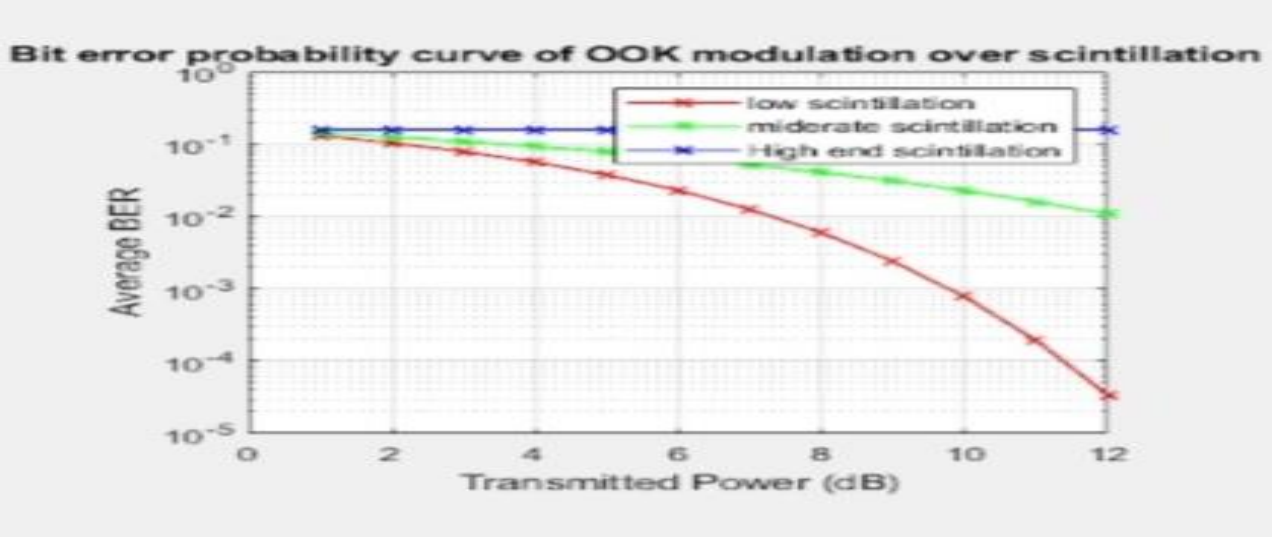


Fig :1 BER performance over scintillation rate

- From this graph we analyzed that average bit error rate increases with increase in scintillation rate which degrades the performance of system.

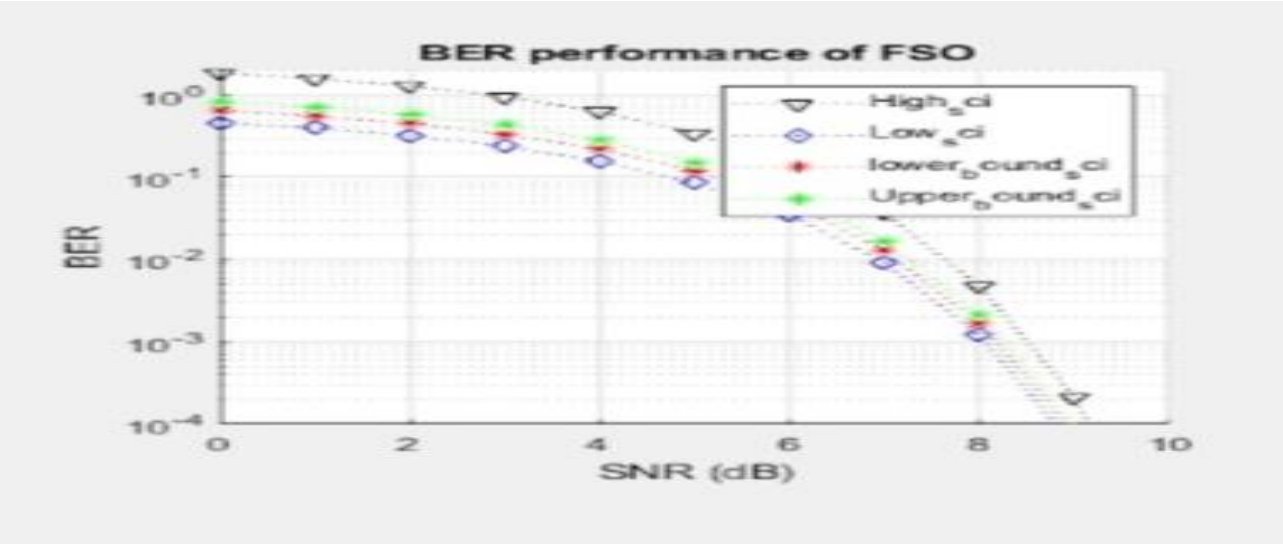


Fig :2 BER vs SNR anlysis over various scintillation rate

- From this graph we concluded that BER increases with increase in SNR over various scintillation rate.

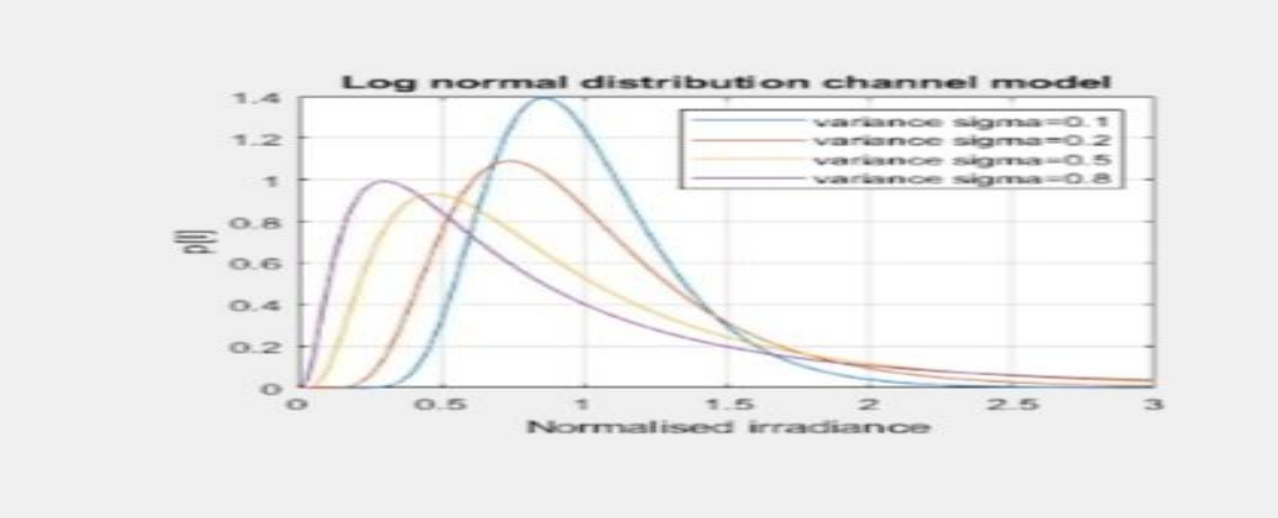


Fig :3 Log normal distribution

- From this graph we can analyze channel model which gives information of channel,by knowing channel state information we can increase the performance of system.

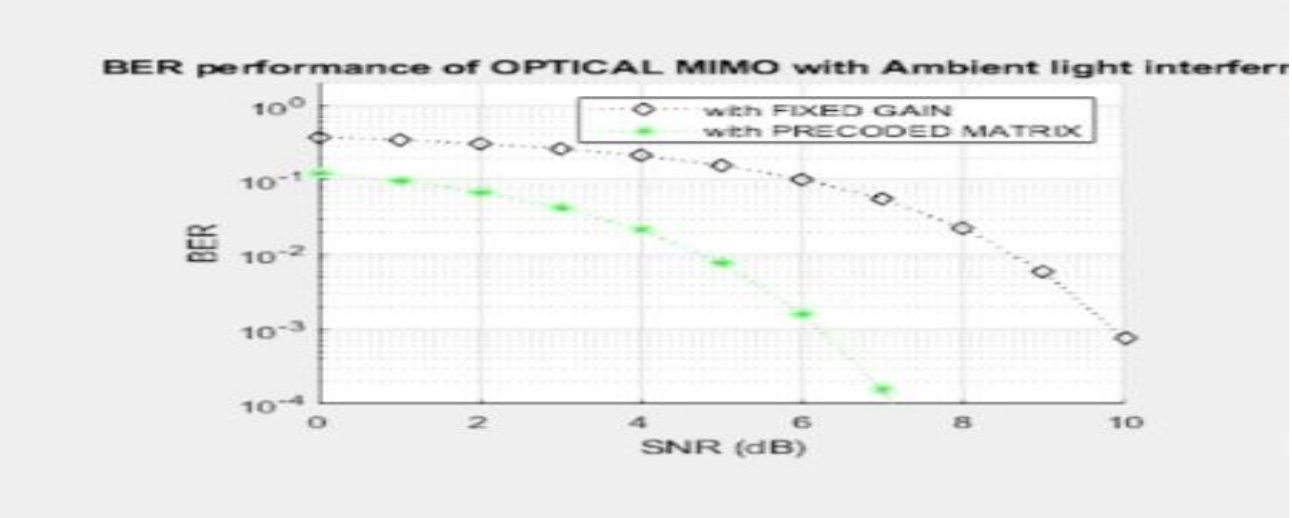


Fig : 4 Performance over path gain

- From this we analyzed that performance of system increases well with precoded matrix as compared to fixed gain.

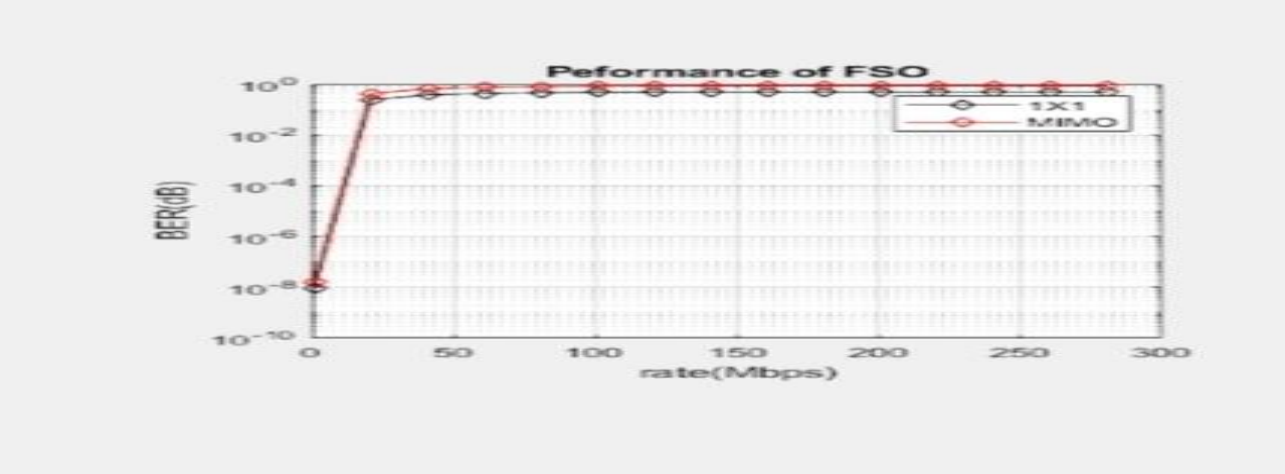


Fig : 5 Data rate analysis

- From this graph we conclude that performance of FSO better in MIMO system when compared to SISO system.

ADVANTAGES

- **S**patial Multiplexing
- Precoding
- Diversity coding

- High data rates
- Low latency

APPLICATIONS

- Environmental Monitoring
- Under water exploration
- Scientific data collection

CONCLUSION

In this paper , we proposed MIMO system for optical communication. Here we carrried out a new attempt for reducing the interferences presented in the channel by actively sum the signal energy obtained from the both the receiving antenna after finding the erfh of the signal . finally we analyze the performance of propsed optical system with various combining techniques to prove the MIMO diversity. Compared to all other techniques proposed method will be the optimium one for MIMO based optical commnication system.

FUTURE SCOPE

Results presented here can be used to further demonstrate the capability of Precoded matrix based modulation with different signal modulation techniques. The analytical model and simulation results helped confirming the feasibility of the adaptive modulation techniques which can be used for the optical wireless channel.

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