International Journal of Research in Advanced Engineering and Technology
ISSN: 2455-0876; Impact Factor: RJIF 5.44
www.engineeringresearchjournal.com
Volume 2; Issue 3; May 2016; Page No. 94-97

An optimum algorithm to improve BER using CDMA technique in underwater communication for BPSK modulation

[1] Jaya T, [2] Aruna Jacintha T, [3] Paranidharan KS, [4] Sathyapriya J, [5] Rajendran V

[1] Research scholar, Dept of ECE, Vels University, Chennai, Tamil Nadu, India
[2, 3, 4] UG Student, Dept of ECE, Vels University, Chennai, Tamil Nadu, India
[5] Professor and Head, Dept of ECE, Vels University Chennai, Tamil Nadu, India

Abstract
In underwater communication, transmission medium suffer some of the factor like multipath propagation, time varation of channel, limited bandwidth and signal strength attenuation is particularly it as range of long distance. In underwater communication, data rate is low compare to terrestrial communication. However, in underwater communication, acoustic wave is used whereas in terrestrial communication electromagnetic wave is used. There is a need for new advanced signal processing techniques for better underwater communication and networking for developing ocean monitoring and exploration. In this project, we proposed an optimum algorithm to improve the Bit Error Rate (BER) for two different channel conditions in underwater wireless communication using Code Division Multiple Access system (CDMA). The proposed system analyzes the Bit Error Rate (BER) performance of slow fading and fast fading channel using digital modulation scheme like Binary Phase Shift Keying. The performance of BER vs SNR (Signal to noise Ratio) is analyzed for slow fading and fast fading channel using MATLAB software and we find that the proposed system provide better BER.

Keywords: CDMA, high data rate, BER, SNR, fast fading, slow fading channel, multipath propagation

1. Introduction
The main challenge of underwater communication is coherent signal over underwater channel and estimation of accurate channel. However the factors gives to thus channel include the long delay spread varation of time in underwater wireless acoustic channel and the transmitted signal with wideband nature. This method motivates deferentially coherent detection as a low complexity alternative which does not require explicit channel estimation. Unlike with single-carrier broadband modulation, where equalization would have to be juggled with deferentially coherent detection**,** orthogonal frequency-division multiplexing (OFDM) easily lends itself to deferentially coherent detection, since each of the carriers conveys only a narrowband signal [1]. In underwater wireless networks are useful for oceanographic data collection, monitoring the environmental condition, an exploration that occur in offshore, preventing the disaster, it also gives warning for nature disasters like tsunami, storm and icebergs, it also helps in navigation assist. Underwater wireless communication is a typical physical layer technology in underwater network. They have unique challenges like harsh underwater environment like limited bandwidth, low data rate, multipath propagation. Temporary losses of connectivity are occurring by multipath, fading and asymmetric. Radio wave that propagates through the conductive salt water at very low frequencies (30-300hz). So, it requires large antenna and high transmission power.

2. Related Work
2.1 Underwater Wireless Sensor Networks (UWSN)
Under Water Sensor Networks (UWSN) applications, include oceanographic data collection, pollution monitoring, disaster recovery, mine detection, and navigation. UWSN we use high-frequency radio Signals in underwater communication. Power efficiency is a critical and chanallenging issues in a protocol design for UWSNs because the transmission is very high and the consumption of acoustic modems [4-5]. In underwater communication uses wireless sensor and its continuously monitoring the environment and the parameters are chemical acticity, temperature, pressure, humidity and light. It support real-time applications like monitoring applications, in which response time is critical. The source is the sea bed. The data collected from the source is forwarded through other sensor which is fixed to the sea bed of water surface. It consists of both radio-frequency signal and acoustic modems, the fixed node receives acoustic signals from the another sensors which is fixed and transmits the messages to the control center ashore through radio-frequency signal [6, 7].

3. Proposed System
The proposed system uses a CDMA technique for efficient bandwidth utilization in underwater communication of two different channel, i.e. slow fading and fast fading channel for BPSK modulation by improving BER. CDMA allows a number of users that share the same bandwidth. However, multiple information signals are transmitted through a single communication channel simultaneously. In CDMA only one carrier is used for modulation [8].
In this system we use four static nodes fixed to seabed and it is a MIMO. Biological noise we have predicted two different channels that is slow fading and fast fading channels in underwater. The noise used in these channels are ambient noise in order to calculate performs of BER vs. SNR for different modulation schemes. In terrestrial communication the noise occurring in the channel is AWGN whereas in underwater communication the noise that occurs is ambient noise.

3.1 Block Diagram of Proposed System

The proposed block diagram of underwater wireless communication is shown in figure 1. A source or sender is one of the basic concepts of communication and information processing. Source are objects which encode messages and transmit the information, via channel to one or more observer or receivers. The source signals are modulated using BPSK technique.

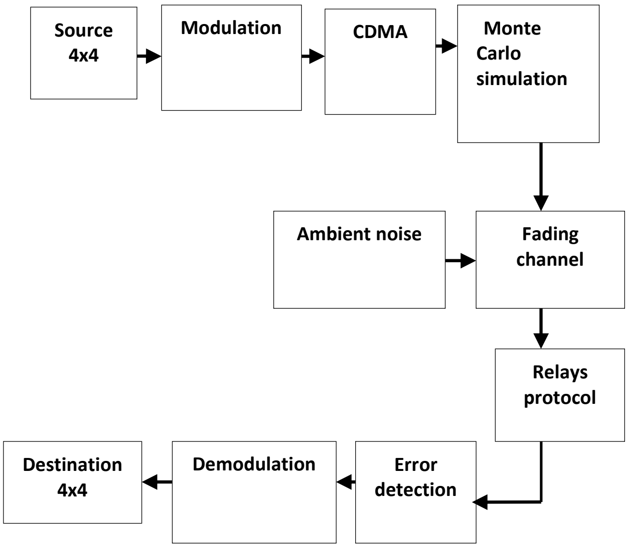

Fig 1: Block diagram of the proposed system

CDMA is a code division multiple access which employes analogy-to-digital conversion(ACD) with the combination of spread spectrum technology. So it can be a defined code. So it can be intercepted only by receiver the frequency response is programmed with the same code. It follows exactly with the transmitted frequency. The CDMA channel is nominally 1.23MHz wide. Monte Carlo simulation is used to check the probability. Is a technique used to understand the impact of risk and inferring solution for the collective result. The Relay protocol is a protocol that transmits a message series of related instant messages in the context of a communications session. Demodulation is extracting the original information-bearing signal from a modulated wave.

4. Result and Discussion

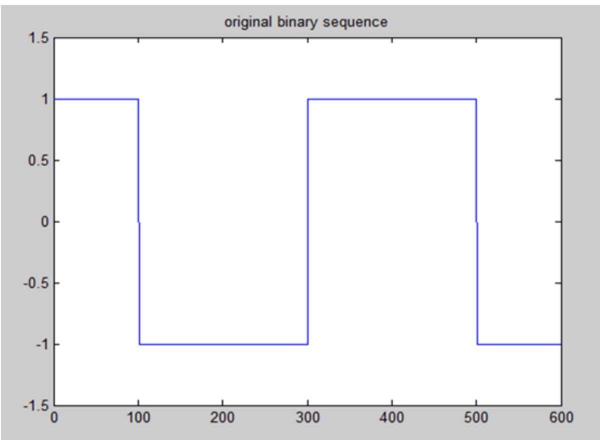

Fig 2: original binary sequence

In figure 2, represents the original binary sequence of Binary Phase Shift Keying modulation. It shows the response of amplitude vs time period in seconds.

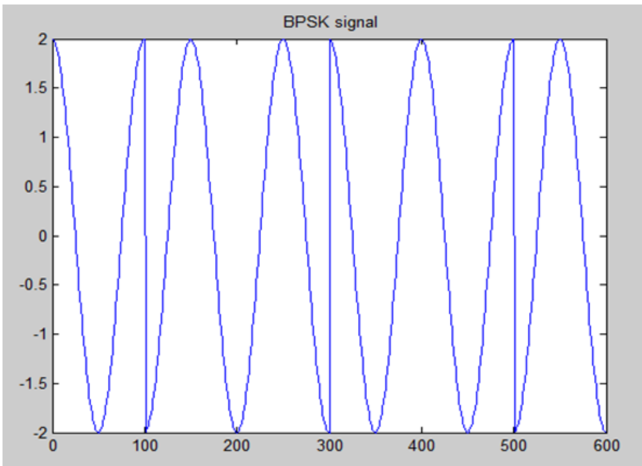

Fig 3: BPSK signal

In figure 3 represents the Binary Phase Shift Keying signal. In this figure x-axis represents the time period in seconds and the y-axis represents the amplitude in volts. The bit stream information is contained in the changes of phase of the transmitted signal. A synchronous demodulation would be sensitive to their phase reversals.

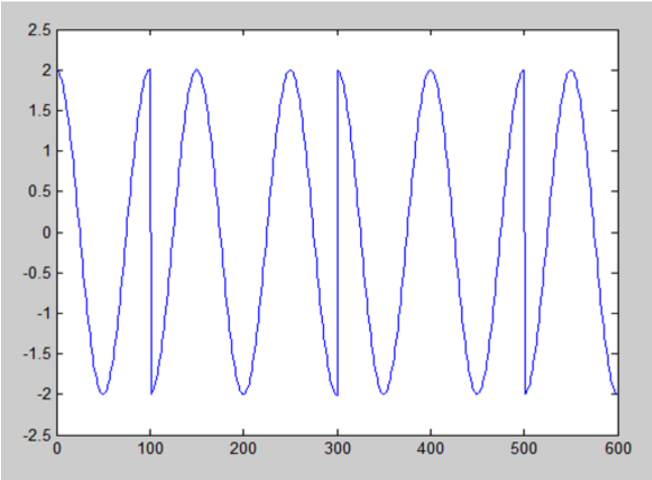

Fig 4: demodulation for BPSK signal

This figure 4, represents the dem odulation signal of BPSK modulation. In x-axis it represents the amplitude in volts and in y-axis it represents the time period in seconds. Demodulated BPSK signal is transmitted in two levels;

1. Recovery of the band limited message waveform with baseband.

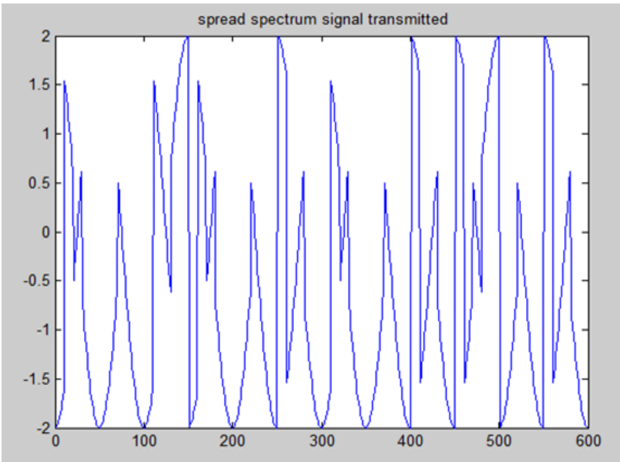

Fig 5: Transmitted spread spectrum signal

2. Regeneration from the transmitted waveform back to the original binary message bit.

The figure 5 represents the spread signal that is transmitted for BPSK signal. The spread spectrum signal is transmitted for BPSK signal. It represents the time period in seconds and in y-axis it represents amplitude in volts.

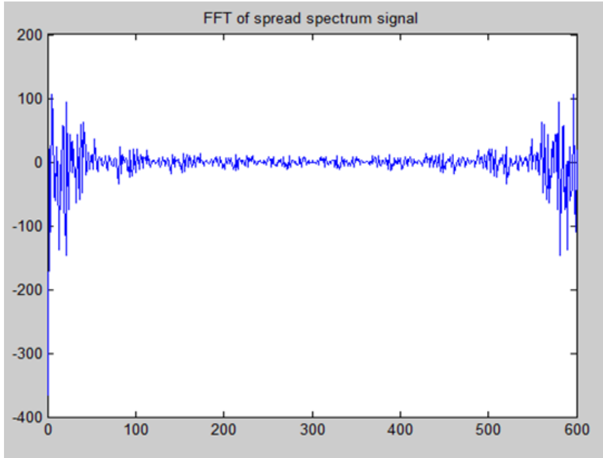

Fig 6: FFT of spread spectrum signal

The figure 6 represents the Fast Fourier Transform of the spread spectrum signal of BPSK modulation. The x-axis represents the time period in seconds and y-axis represents the amplitude in volts. The Fast Fourier Transform (FFT) is a method of calculating the DFT. While it produces the result with more efficiency.

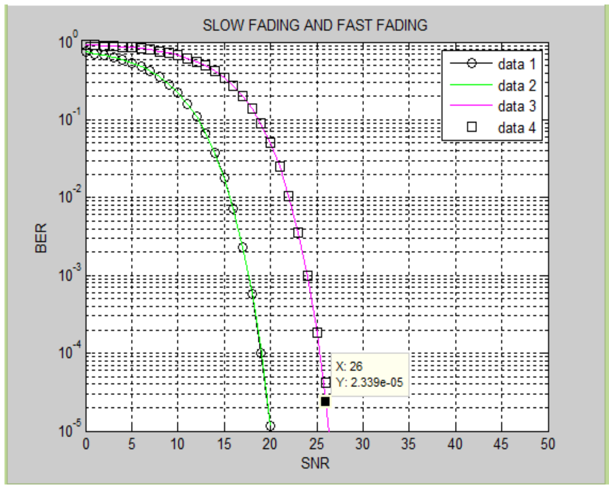

Fig 7: BER probability curve for CDMA in BPSK signal for slow fading and fast fading

The figure 7 represents the BIit Error Rate (BER) probability curve for CDMA technique in BPSK signal for slow fading and fast fading channel. The x-axis represents the SNR in db and y-axis represents the BER. For BPSK signal the slow fading is achieved 1.154e^{-05}in 20dB and fast fading is achieved 4.231e^{-05} in 26dB as shown in Table.1.

Table 1: BER vs SNR for slow fading and fast fading channel in BPSK modulation

S. No.	SNR in dB	BER	
		Slow Fading	Fast Fading
1	5	0.5371	0.8483
2	10	0.2221	0.6737
3	15	0.01745	0.3473
4	16	0.007117	0.2725
5	17	0.002313	0.2027
6	18	0.0005362	0.1404
7	20	1.154e-05	0.05014
8	25		0.0001846
9	26		4.231e-05

5. Conclusion

In this paper we have analyzed the performance of BER by using optimum algorithm for slow fading and fast fading channel using CDMA technique in underwater wireless communication. We use modulation technique BPSK for two different channels to improve BER. The noise used in the channel is ambient noise like biological noise, traffic noise, wind noise and turbulence noise. Thus, we have proved that the BER is10^{-5} at 20db for slow fading and 10^{-05} at 26db for fast fading channel improved by using the proposed technique. In future we may propose Multi Carrier-Code Division Multiple Access (MC-CDMA) technique to improve BER performance in underwater wireless communication with efficient bandwidth utilization and high data rate.

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