

Analysis of Underwater Communication Using IDMA with Different type of Noise

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ABSTRACT: In this paper, we propose IDMA over underwater acoustic (UWA) channels with experimental results. We also extend the original IDMA to a multiple hydrophones scenario to improve the bit error rate (BER) performance. Experimental results show that with multiple hydrophones, the coded BER performance of IDMA approaches zero after only a few iterations, validating the feasibility of our proposed approach over UWA channels. In this paper QPSK modulation technique is used for underwater communication. A Chip level DFE-based receiver is optimized using the mean square error criterion (MSE), which is generated by exchanging soft information in terms of log-likelihood ratio (LLR) estimates with each user's channel decoder

KEYWORDS: Underwater communication, IDMA, BER, CDMA, UWA, BER

I. INTRODUCTION

In the wireless communication system Multiple Access technique is one of the key technique for cellular mobile communication systems. There are many techniques used to improve the bandwidth, efficiency, and increased the number of users that can be accommodated within each cell. There are required high data for high mobility(100mbps) and 1Gbps for low mobility[1]. To fulfill these requirements are usually considered as forth generation as well as fifth generation. There are many multiple access techniques which is used for 1G/2G/3G systems such as FDMA/TDMA/CDMA are basically suitable used for voice communication only but for high data rate 4G system are used with DS-CDMA technique. 4G systems provide the high data rate around 100Mbps as compared to 3G systems which is provide around 3.6-7.2 Mbps data rate. CDMA technique widely used in 3G system due to its robustness to channel impairments and immunity against interference. it have many features like as dynamic channel sharing, soft capacity, reuse factor in cellular systems. it have the batter bandwidth as well as efficiency as compared to both schemes TDMA and FDMA. But it have many limitations like as limited by multiple access interference (MAI), as well as intersymbol interference (ISI).[2,3]The CDMA have a major disadvantage of complexity to the multiuser detection . To overcome this disadvantage we are using a new multiple access technique that is INTERLEAVE DIVISION MULTIPLE ACCESS(IDMA).In this technique interleaver are used to provide the separation between the users.

II.IDMA SCHEME

As per the demand of high data rate there is a big challenge to gain high data rate with existing multiple access technologies like as TDMA, FDMA, OFDMA. These techniques have many problems such as inter-cell interference and frame synchronization which is used for maintaining orthogonality. The challenge was to combat intra cell interference .So there was a new technology introduced name as INTERLEAVE DIVISION MULTIPLE ACCESS(IDMA). IDMA can be consider as the special case of DS-CDMA. In DS CDMA data is separated by different spreading codes but in IDMA data is separated by interleavers. IDMA gives excellent bit error rate (BER) performance, spectrum usability, and low complexity at the receiver.[3] . IDMA also be provides very high gain. This

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scheme gives a low complexity for multiple user detection technique which is used to the systems with large number of users in multipath channels at the same time. The spreading process of a data is done before interleaving in the transmitter part of IDMA. The spreading process for all users can be same. In the code division multiple access (CDMA) systems the Performance the systems is mainly limited by multiple access interference (MAI) and inter-symbol interference (ISI). In the code division multiple access system used the same transmission media caused the signals from different users are superimposed are create the multiple access interference (MAI) problem. The Multiple access interference (MAI) is a effect in communication system which limits the capacity as well as the performance of DS-CDMA systems. IDMA is proposed as a new spread spectrum technique in 4G system.

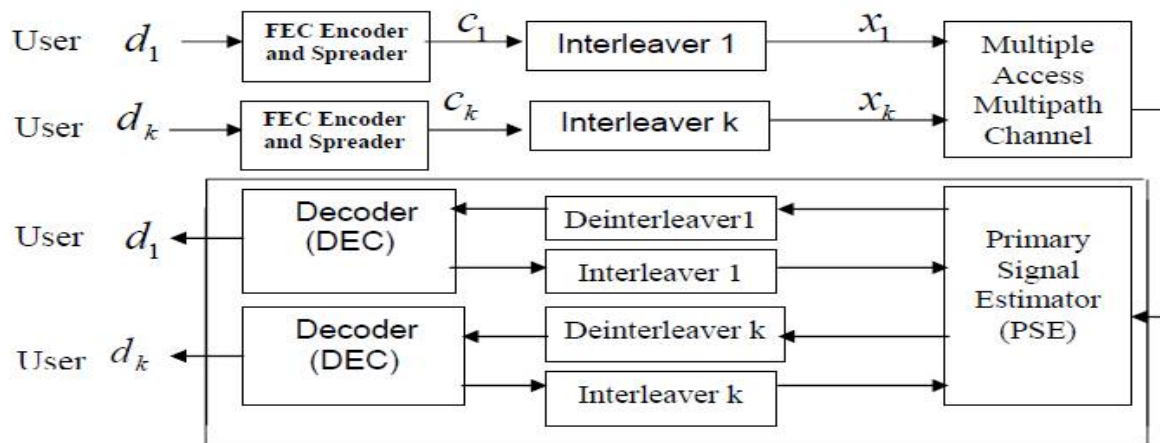


Fig. 1 IDMA transmitter and receiver structure

III.NOISE AND LOSSES

a. Manmade noise:

This type of noise is mainly caused by machinery noise (pumps, reduction gears, power plants), and shipping activity(hull fouling, animal life on hull, cavitations), especially in areas encumbered with heavy vessel traffic.

b. Ambient noise:

Is related to hydrodynamics (movement of water including tides, current, storm, wind and rain), and to seismic and biological phenomena.

c. Thermal Noise:

Thermal noise is the spontaneous microscopic fluctuations that occur naturally in a molecular system at finite temperature. With the advent of nanotechnology, there has been considerable interest in understanding the role of thermal fluctuations in nanofluidic dynamics and transport. It has been argued that thermal fluctuations can influence the flow characteristics and are expected to play a significant role in nanoscale transport.^{1,2} An understanding of the interplay of thermal noise on the fluid dynamics and transport inside nanoscale systems is essential for understanding the mechanism of distinctive nanoscale phenomena such as single-file transport³ and a possibility of thermal noise induced/assisted unidirectional transport.⁴ In the last decade, few theoretical and molecular dynamics (MD) simulation studies have been performed that report the unforeseen role of thermal fluctuations in nanofluidic transport.

d. Attenuation:

Is mainly provoked by absorption caused by the conversion of acoustic energy into heat. The attenuation is also caused by scattering and reverberation (on rough ocean surface and bottom), refraction and dispersion (due to the displacement of the reflection point caused by wind on the surface). Water depth plays a key role in determining the attenuation.

e. Depth Dependence:

Depth can have a large impact on side scan sonar and underwater data transmission. If the frequency is high enough so

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that $MgSO_4$ is the major attenuation effect, we can multiply α by the pressure effect, P_2 . [15] As an example, $\alpha = 40$ dB/km at the ocean surface, 30 dB/km at 2000 m, and 22 dB/km at 4000 m.

IV. RESULT

The execution is performed in programming language MATLAB. In this paper, consider many noises and losses for underwater communication. With the help of simulator in MATLAB the IDMA transmitter and receiver has been successfully implemented with different noise and loss. Acoustic signal propagation in the water and attenuation in Boric Pure Water is shown in fig.2,3. The BER rate by using QPSK modulation technique is shown in fig.4.

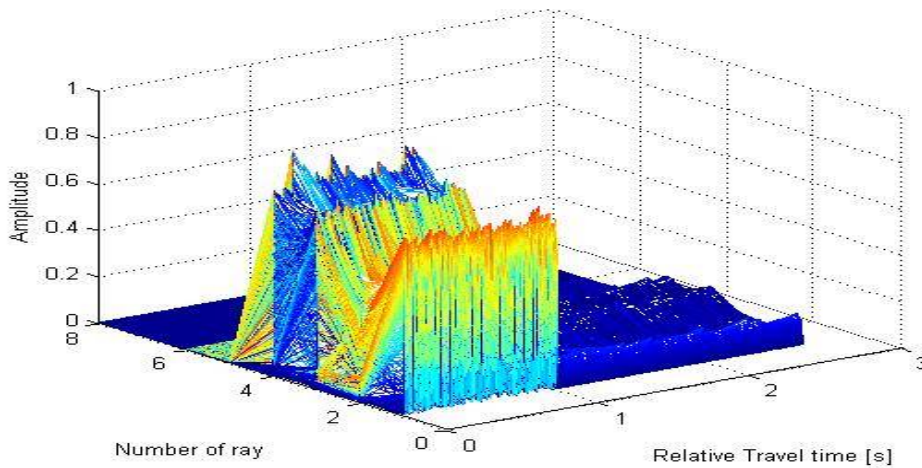


Fig. 2 Acoustic signal propagation

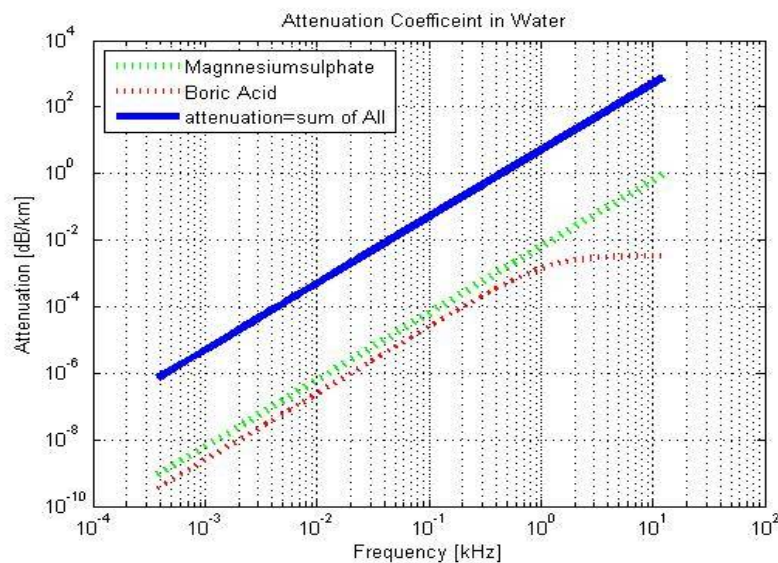


Fig 3 Attenuation in Boric Pure Water

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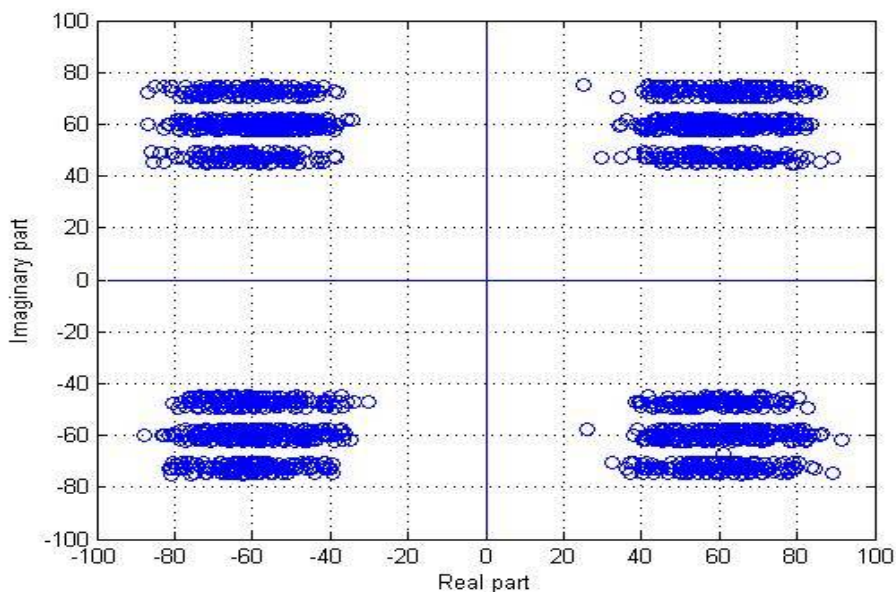


Fig 4 Direct path QPSK

The packet which could not be synchronized using the correlator were synchronized manually by observing the received burst in the time domain. The estimated values for α and β for each packet are shown in above figure and a comparison of the BERs obtained by applying the two Doppler correction techniques under consideration.

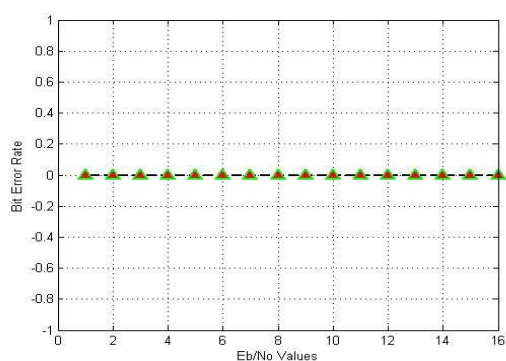


Fig 5 direct path signal to noise ratio

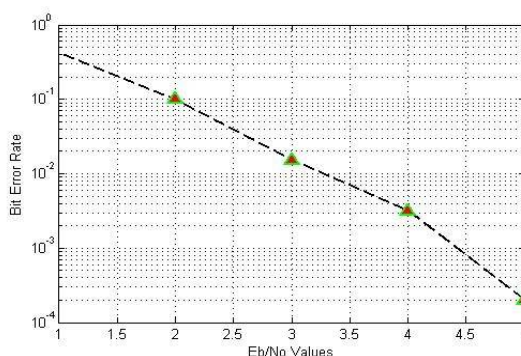


Fig. 6 Multi path signal to noise ratio

The Bit Error rate and Signal to Noise ratio are shown in above fig. 5 for direct path and fig. 6 for multi path communication system for multiple users.

V.CONCLUSION

On the basis of present study, it is observed that in direct path IDMA, signal losses are less and in multipath propagation losses are more.

Direct path IDMA can be considered preferable in respect to two performance metrics, namely:

1. BER (Bit Error Rate)

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2. SNR (Signal To Noise Ratio)

BER remains constant if we increase E_b/N_0 to a great extent. But in multipath propagation, the value of BER and E_b/N_0 depend on each other. If we increase the value of E_b/N_0 then it provides low BER, but if the value of E_b/N_0 is kept small then the value of BER is high, which is not appropriate for a signal.

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