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Channel coding in Underwater Communication Using Turbo Code

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Abstract— *The Deep-sea shows the phenomenon of varying acoustic sign communication because of non-stationary scenery. At any point of the period, water provisions among source and receiver are not static. Accordingly, for underwater acoustic tenders scheming of a wireless communication structure turn out to be significantly inspiring. In water, the speediness of sound is approximately 1500 m/s due to the multipath phenomenon; this presents great delay. The great period delay originates Inter-symbol Interference; this, in turn, reduces numerous receivers' performance. The objective of this paper is to present Interleaver Division Multiple Access Orthogonal Frequency Division Multiplexing Multiple Input Multiple Output technique, with Turbo code combined with Random, Matrix, Helical interleaves, and BPSK, QPSK, QAM modulation methods. The simulation results reveal that Turbo code with random interleaver and BPSK modulation gives BER up to* 10^{-5}.

Keywords — *Turbo, Random interleaver, BPSK.*

I. INTRODUCTION

As radiofrequency waves necessitate large antenna dimensions and high communication power, underwater acoustic communication typically rests on acoustic communication [1][2]. Optical waves do not travel much distance and require line-of-sight between the transmitter and the receiver so that it is difficult to communicate in mobile nodes. In the current ages, underwater wireless communication has added ample consideration for applications like unmanned submarines, underwater robots, and wireless acoustic sensor nodes [3][4]. For information broadcast, the shallow-water network is measured to be the maximum hard medium. For underwater acoustic applications evolving a reliable data communication scheme is thought-provoking, and the main problems in underwater communication are multipath, interfering, and bandwidth. In the Orthogonal frequency division multiplexing (OFDM) process, a minute data stream is separated into similar data streams individually with a little tiny amount, and this similar data stream is additionally moderated with numerous modulation subcarriers and communicated on an additive white Gaussian noise (AWGN) station. This duck the covering of respectively sub-carrier frequency, therefore, removes inter-carrier interference [5][6][7]. Today OFDM system is used in worldly alphanumeric radio and television distribution requests [8][9]. The elementary impression overdue OFDM modulation is indefinite but applying an overlying multi-carrier modulation for substituting a wideband symbol to concurrently diffused narrowband indications. To instrument OFDM transmitter and receiver in separate periods, IFFT and FFT are used [10]. To lessen Inter Symbol Interference, the OFDM sign period must be larger enough than extreme delay spread [11] [12].

Due to the result of multi admittance interfering and inter-sign interference, the CDMA method's routine is restricted [13] [14]. IDMA pays modest mark by mark iterative multi-operator finding system that positions out only from CDMA. IDMA is greater than CDMA in deference of maximum spectral effectiveness, uses mark by mark inserting procedure kinds project of iterative receiver little composite likened to RAKE handset, it distinguishes signs from dissimilar operators and does not limit with station coding. This paper carries elementary defiance of the IDMA OFDM MIMO scheme for underwater wireless-acoustic communication and investigation of Bit Error Rate. OFDM is a multi-carrier modulation technique, splits a high data stream into a low rate data stream, and transmits material.

II. BLOCK DIAGRAM

As shown in figure 1., at the transmitter side, the input binary data is applied to the Turbo code, interleaved using a random matrix, helical interleavers, and modulated using BPSK, QPSK, QAM modulation techniques. At the receiver side, the received data is demodulated, deinterleaved, and decoded.

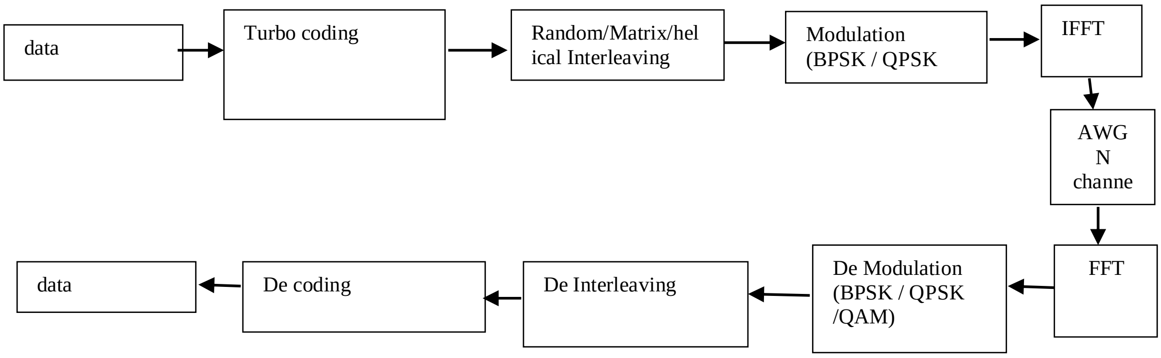

Fig 1: IDMA OFDM MIMO

III. RESULTS AND DISCUSSION

The performance of IDMA OFDM MIMO is compared by taking coding technique as Turbo code. Modulation methods BPSK, QPSK, QAM, are combined with Random, Matrix, Helical interleaver, and results are compared as shown in table1 and plotted as shown in Figure 2, Figure 3, Figure 4 Figure 5, Figure 6, Figure 7, Figure 8, Figure 9 Figure10, Figure 11.

TABLE I PERFORMANCE PARAMETER COMPARISION

modulation	coding	interleaver	BER	Power consumption
BPSK	Turbo	random	10^{-5}	34
QPSK	Turbo	random	10^{-3}	34
QAM	Turbo	random	10^{-3}	32
BPSK	Turbo	matrix	10^{-3}	34
QPSK	Turbo	matrix	10^{-3}	34
QAM	Turbo	matrix	10^{-3}	32
BPSK	Turbo	helical	10^{-3}	30
QPSK	Turbo	helical	10^{-3}	31
QAM	Turbo	helical	10^{-3}	31

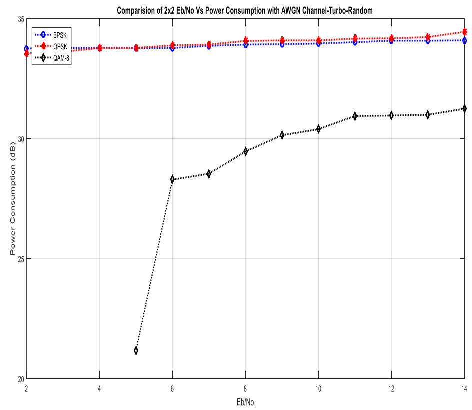

Fig 2: Power consumption with Turbo code and Random interleaver

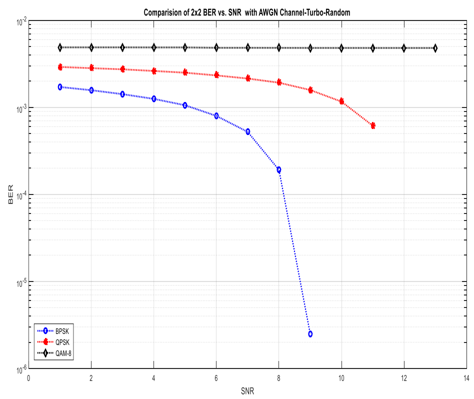

Fig 3: BER with Turbo code and Random interleaver

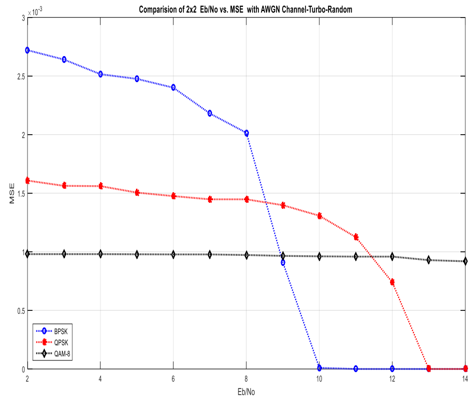

Fig 4: MSE with Turbo code and Random interleaver

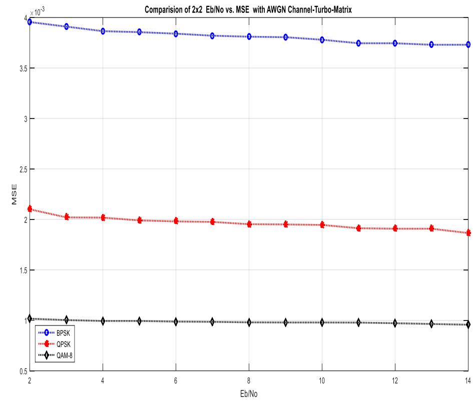

Fig 7: MSE with Turbo code and Matrix interleaver

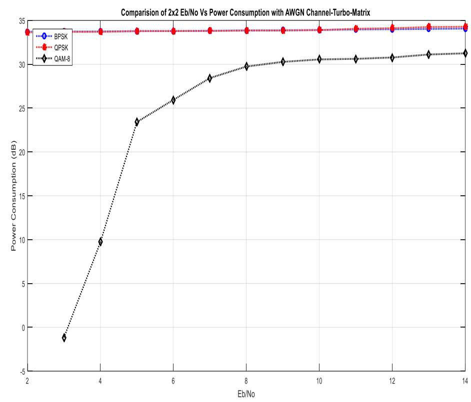

Fig 5: Power consumption with Turbo code and Matrix interleaver

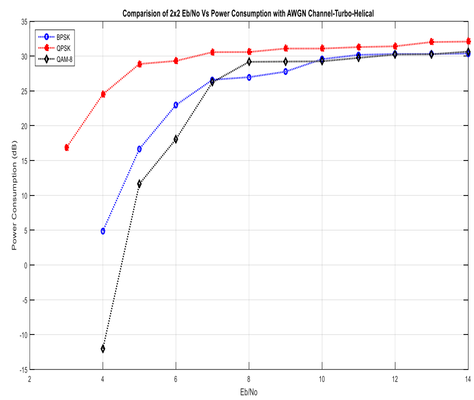

Fig 8: Power consumption with Turbo code and Helical interleaver

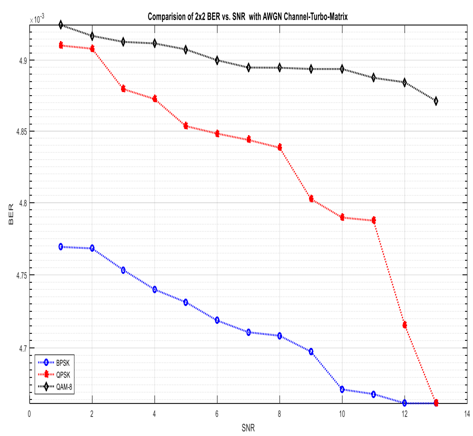

Fig 6: BER with Turbo code and Matrix interleaver

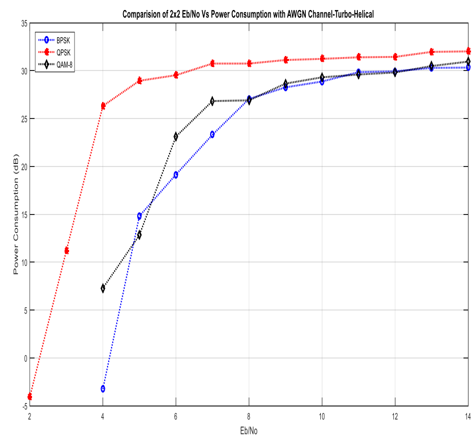

Fig 9: Power consumption with Turbo code and Helical interleaver

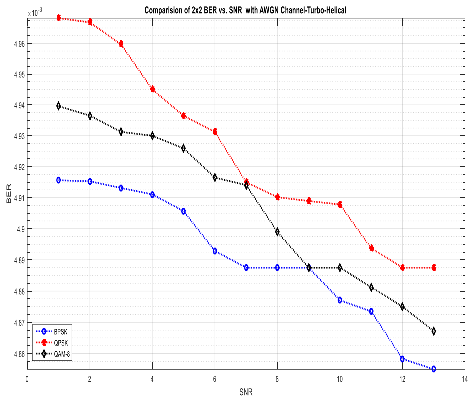

Fig 10: BER with Turbo code and Helical interleaver

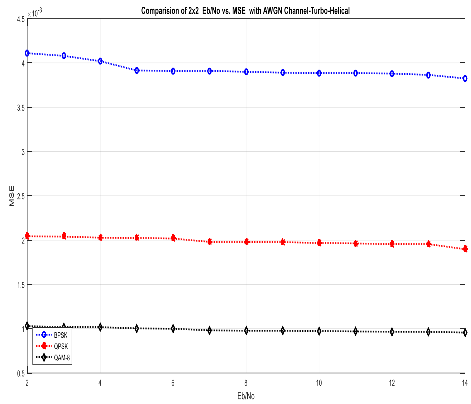

Fig 11: MSE with Turbo code and Helical interleaver

IV. CONCLUSION

This paper presents Interleaver Division Multiple Access Orthogonal Frequency Division Multiplexing Multiple Input Multiple Output with Turbo code combined with Random, Matrix, Helical interleaver and BPSK, QPSK, QAM modulation techniques. The simulation results demonstrate that the combination of BPSK with Turbo code (Random Interleaver) improves BER up to 10^{-5}.

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