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PERFORMANCE ESTIMATION OF OPTICAL INTERLEAVE DIVISION MULTIPLE ACCESS TECHNIQUE WITH SPECIFIC SEED LENGTH PRIME INTER-LEAVER AT ZERO DISPERSION WAVELENGTH

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ABSTRACT

The influence of seed length on the performance of an OIDMA system for prime inter-leaver is discussed in this article. In a multiuser system, the Prime Inter-leaver plays a crucial role in user separation. Various seed length prime inter-leavers are built and deployed in the OIDMA system for performance evaluation in this research work. The BER is estimated by varying number of users, and the results are extensively examined. On MATLAB, the entire OIDMA system is simulated.

Keywords: Prime Inter-Leaver, Spread Length, Seed Length, Zero Dispersion, Wavelength, Processing Gain, Optical Window.

Abstract

The influence of seed length on the performance of an OIDMA system for prime inter-leaver is discussed in this article. In a multiuser system, the Prime Inter-leaver plays a crucial role in user separation. Various seed length prime inter-leavers are built and deployed in the OIDMA system for performance evaluation in this research work. The BER is estimated by varying number of users, and the results are extensively examined. On MATLAB, the entire OIDMA system is simulated.

Keywords: *Prime Inter-Leaver, Spread Length, Seed Length, Zero Dispersion, Wavelength, Processing Gain, Optical Window.*

1. INTRODUCTION

Interleaving is a technique used in communication devices to overcome related channel noise, as well as burst error and fading. To increase the overall performance of forward mistakes correction codes, interleaving is widely utilized in verbal exchange systems. The user-specific inter-leaver plays a key role in the IDMA device's efficiency. The current couple of entry method, which is used in 1G/2G/three/G machines, has a maximum data rate of around 72 Mbps [1-3]. In a 4G system, we should charge a higher data fee than in a 72 Mbps system. The CDMA system, which is commonly used in Wi-Fi communication, has its own set of restrictions, including multiple accesses to interference (MAI) and inters image interference (ISI). Multiuser identification (mud) is also a complicated problem, especially for large numbers of users. IDMA is a new method that fulfils the criteria of 4G architecture and helps to solve problems in CDMA and MC-CDMA (multicarrier) CDMA. IDMA can be thought of as a specific case of direct collection code department with multiple DS-CDMA accesses [4-6]. Data streams in IDMA are separated using diverse inter-leavers rather than the unusual spreading codes used in DS-CDMA. The proposed O-IDMA device employs inter-leavers in an optical channel rather than a wireless channel. As we become more aware of the higher. Overall optical channel performance in terms of SNR, BER, ISI, cost, and support for correct data rates in the thousands of Gbps range. To reduce the complexity of mud, an iterative chip by chip multiuser detection technique is utilized inside the machine [7-10]. As a result, it benefits a wider range of clients.

2. OPTICAL IDMA SYSTEM

Within the proposed block diagram of an IDMA System [Fig. 1 and Fig. 2], the consumer creates the base band signal, which is typically a speech signal with a frequency of 300-3400Hz and a bandwidth of 4 KHz [11-12]. There are q users who make voice indicators. This signal is converted into a virtual signal by the use of sampling, quantization, and coding, resulting in a data rate of 64 KHz for each signal. Information is processed and channel coding is used before being sent to the modulator. FEC (Fast Error Correction) coding is used to improve error detection and correction. In this example, we haven't employed any FEC. For this motive, we will employ cyclic codes, hamming codes, RS codes, and Convolutional codes. After coding, the coded records are spread out using the PN series. In this scenario, an equal PNS series is employed to distribute all users evenly. The unfold sign is subsequently transmitted to the inter leavers in question. We have taken tree inter-leavers for

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evaluation purposes in the gift example. All of the interleaved bits from the various q users are multiplexed together and then converted into an optical signal using a 1330 nm wavelength optical source. For this reason, fiber parameters like as dispersion, attenuation, go section, numerical aperture, and bending loss are taken into account.

With the use of an Avalanche picture diode, the optical signal is first converted into an electrical signal at the receiver. The elementary sign estimator ESE receives all of the interleaved and multiplexed coded bits. For determining LLR and APP values, a software-based technique is employed going to the decoders for customer discrimination If there are any errors, the fantastic person's feedback mechanism is linked in the comments direction for any rectification. In comparison to the CDMA technique, all users are separated in this manner with less complexity. Convolutional coder can be used to improve the overall performance of the IDMA device [13-14].

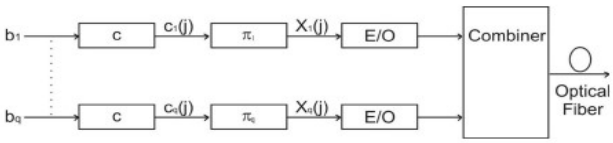

Fig. 1 Optical IDMA Transmitter System

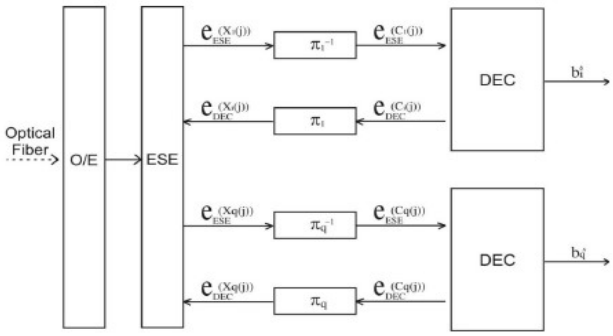

Fig. 1 Optical IDMA Receiver System

3. PRIME INTERLEAVER

Though the random inter-leaver is the most effective type of inter-leaver, it requires a large memory. In order to reduce recollection space in random inter-leavers, a special type of inter-leaver is devised that is entirely based on large numbers. The proposed high inter-leaver has the ability to gain less bandwidth and spends the least amount of power when transferring facts [14-15]. When compared to random inter-leaver, it provides better overall performance [15-16]. The era variety is based solely on seeds, with the most successful high variety seeds, which is why it's known as high inter-leaver. The following is the precept to be concerned about in the era of user-precise high inter-leaver: First, we need to figure out which seed is designated as P. The procedure for determining an exact high inter-leaver is as follows: initially, we find the seed designated as P. Use a high seed P if we need N bits interleaved. On a Galio region G [N], define N bits. On G [N], seed denotes the separation of interleaved bits [17-18].

To comprehend the phenomenon of top inter-leavers, for example. Let us assume that seed is counted as five. Let's say G [N] is three, four, or eight... Allow N = eight for the purpose of simplicity. Our goal is to interleave N bits with seed five, and the interleaved bits that results are as follows.

1. 1
2. (1+1x5) mod 8=>6
3. (1+2x5) mod 8=>3
4. (1+3x5) mod 8=>8
5. (1+4x5) mod8=>5
6. (1+5x5) mod 8=>2
7. (1+6x5) mod 8=>7
8. (1+7x5) mod 4=>4

As a result, the interleaved collection for G [8] is generated [1, 2, 3, 4, 5, 6, 7, 8].

[1, 6, 3, 8, 5, 2, 7, 4] is a one-of-a-kind collection. A collection that is interlaced.

We shall see the simplest seed value using this common sense in hardware. This reduces the amount of memory space available. The intricate shape of random inter-leavers is reduced by using high inter-leavers, which reduces the size, fee, and electricity consumption.

4. SIMULATION RESULT AND DISCUSSION

The whole OIDMA System is simulated on MATLAB. Here coding and modulation section is not programmed & counted in OIDMA scheme for avoiding programming complexity. Some parameters such as Spread length 16, Block length 25, Optical parameters like optical source of 1330 nm zero dispersion wavelength fiber length, Aeff & APD

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Detector etc. We have varied the seed length PR = 7, 11, 13 and 17 & for each seed length BER is calculated with varying number of users for m=1024 & m=2048 respectively.

Table 1 gives the tabular form representation of BER verses number of users for different seed length. The Graphical view is plotted in Fig. 3 for table-1 at fixed value of m i.e., 1024. It is observed from table-1 that for fixed seed length PR=7 as the number of users increases BER increases for example when number of user is 50 , BER is 7.8125 x 10^{-7} which increases 1000 times i.e., 1.5352 x 10^{-4} for 100 users. This trend is in well agreement with theoretical facts that if number of users increases Multiple Access Interference (MAI) increases which enhances the bit error rate. Same trend is obtained for different seed length i.e., PR = 11, 13 & 17. In Graphical representation of Table-1 as depicted in fig. 1, Different color shows the various seed lengths and in all cases with some exception bit error rate is increasing with number of users. By comparing the result of BER at various seed length it is observed that BER is lowest for seed length (PR) = 7 for less number of users. Though various seed length graphs coincides with higher number of users.

In Table 2, keeping all the parameters fixed as in previous cases except value of m is doubled i.e., 2048. The Observed reading of BER are plotted in graphical view in Fig. 4. The trend of reading shows same pattern as observed in Fig.3. If we compare the reading of Fig. 3 & Fig. 4, the result of Fig. 4 is superior as compared to Fig.3. For example in table-1 for PR=7, at no. of users 80, BER is 7.2510 x 10^{-5}which reduces up to 1.89898 x 10^{-5} for PR=7 and no. of user 80. Same trend is obtained almost all seed length 11, 13 &17. Thus reduction is also agrees with the theoretical facts that, as sample value is encoded in more number of coded bits (N) results are improved as observed in readings that for m = 1024 (N=10) & for m = 2048 (N=11).

Table 1: Block Length =50, Data Length =1024, SL=16, PR=12800

No. of Users	B.E.R. (PR = 7)	B.E.R. (PR = 11)	B.E.R. (PR = 13)	B.E.R. (PR = 17)
40	0	0	0	4.8828 x 10^{-7}
50	7.8125 x 10^{-7}	3.9063 x 10^{-7}	3.1250 x 10^{-6}	7.8125 x 10^{-7}
60	1.3021 x 10^{-6}	3.9063 x 10^{-6}	3.2878 x 10^{-5}	2.6042 x 10^{-6}
70	2.5112 x 10^{-6}	6.4174 x 10^{-6}	4.1250 x 10^{-5}	1.8136 x 10^{-5}
80	7.2510 x 10^{-5}	5.4443 x 10^{-5}	5.6396 x 10^{-5}	4.3945 x 10^{-5}
90	9.9795 x 10^{-5}	8.2517 x 10^{-5}	7.8125 x 10^{-5}	3.0165 x 10^{-5}
100	1.5352 x 10^{-4}	1.3789 x 10^{-4}	1.5723 x 10^{-4}	9.6761 x 10^{-4}

Table 2: Block Length =50, Data Length =2048 SL=16, PR=12800

No. of Users	B.E.R. (PR = 7)	B.E.R. (PR = 11)	B.E.R. (PR = 13)	B.E.R. (PR = 17)
40	0	0	0	0
50	0	0	1.9531 x 10^{-7}	0
60	0	1.6276 x 10^{-7}	1.9531 x 10^{-6}	7.9753 x 10^{-6}
70	0	9.7656 x 10^{-7}	4.1853 x 10^{-6}	1.6741 x 10^{-5}
80	1.8989x 10^{-5}	2.0752x 10^{-6}	3.6865x 10^{-5}	2.3682 x 10^{-5}
90	2.9199 x 10^{-5}	2.4197x 10^{-5}	4.1884x 10^{-5}	4.0430 x 10^{-5}
100	3.4668x 10^{-5}	4.502x 10^{-5}	5.4004x 10^{-5}	4.1667 x 10^{-5}

4. CONCLUSIONS

By analyzing the results it was observed that Prime Inter-leaver with specific seed length will give low BER for larger traffic intensity. As we increase seed length from PR=7 to higher values results are pessimistic. The optimum values are obtained when PR=7 & PR=11 with some exception. As values of m increases from 1024 to 2048 and onwards results are optimistic. We have used zero dispersion wavelength 1330 nm for transmission which also reduces the loss & improves the BER. Overall we can conclude that by using specific seed prime Inter-leaver in OIDMA system is a better alternate to replace existing multiple access technique in modern Communication Networks.

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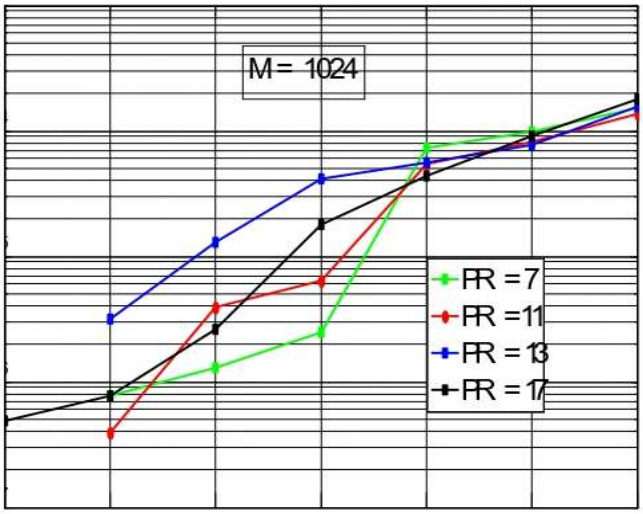

Fig. 3 Performance Analysis of OIDMA Using Different Seed Length (PR = 7, 11, 13 and 17) and Data Length (M = 1024)

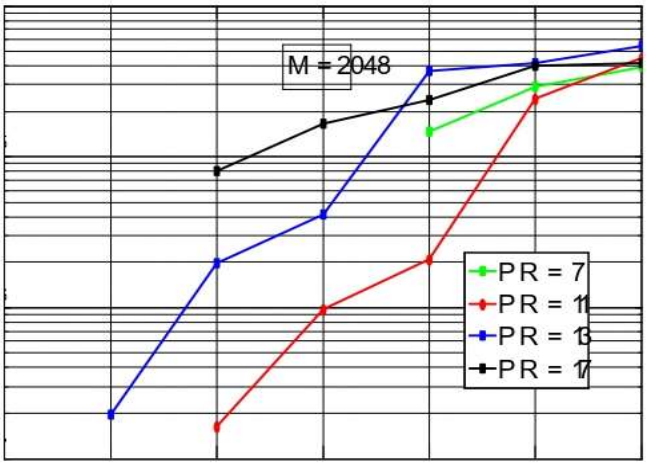

Fig. 4 Performance Analysis of OIDMA Using Different Seed Length (PR = 7, 11, 13 and 17) and Data Length (M = 1024)

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