A Novel Orthogonal Minimum Correlation Spreading Code in CDMA System

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Abstract

Code Division Multiple Access (CDMA) is a technique in which transmission of information takes place simultaneously over the same available channel bandwidth. CDMA systems make use of spread spectrum (SS) technique for transmission of information by employing spreading codes. Each user is assigned with a unique spreading code which acts as a signature code for that individual user. The CDMA system experiences Multiple Access Interference (MAI) and Inter Symbol Interference (ISI) because of the non-orthogonality of the spreading codes. Both the MAI and ISI are the functions of auto-correlation and cross-correlation values of the spreading code respectively. In this paper, a novel orthogonal spreading code called "Orthogonal Minimum Correlation Spreading Code" (OMCSC) has been proposed which can serve a large number of users and is simultaneously expected to reduce the effect of MAI and ISI. Moreover, the Bit Error Rate (BER) performance of the proposed code has been compared with the existing codes using Additive White Gaussian Noise (AWGN) channel under multi-user scenario.

Index Terms: BER, CDMA, MAI, ISI, OMCSC, AWGN.

1. Introduction

The performance of CDMA based wireless systems is largely based on the characteristics of user specific spreading codes [1]. These codes spread the original information signal to a large bandwidth and also provide unique identity to the various channels originating from base station as well as mobile station. At the receiver side, the original information signal is recovered by correlating the received signal with the synchronized replica of the spreading code [2-3]. Thus spreading codes play an important role in CDMA system to spread the user signals and distinguish among different users. Among the different spreading codes, Walsh code has proved its existence as a popular orthogonal code. On the other side Pseudo-Noise sequence (PN), Gold code

and Kasami codes are found to be popular non-orthogonal binary spreading codes.

Non-orthogonality between spreading codes in CDMA system users causes MAI which consequently restricts the capacity of CDMA systems. Many strategies have been proposed to moderate the effect of MAI, for example, multiuser detection can be employed to use multiple user information for better detection of each user signal rather than using single conventional detection [4]. Here the conventional DS-CDMA detector follows a single user detection strategy in which each user is detected separately without regard for the other users. So a better strategy is multiuser detection, where information about multiple users is used to improve detection of each individual user.

Sarwate D. V. & Pursley [5] presented a survey and provided several results on periodic and aperiodic cross-correlation functions for pairs of m-sequences and for pairs of related (but not maximal-length) binary shift register sequences. The relation between the cross-correlation and autocorrelation function has also been included for complex-valued sequences. Multi-value CDMA spreading codes can be designed by means of a pair of mirror multi-rate filter banks based on some optimizing criterion [6]. It explains that there exists a theoretical bound in the performance of its circular correlation property, which is given by an explicit expression. Based on this analysis, a criterion of maximizing entropy is proposed to design such codes. A computer simulation result suggests that the resulting codes outperform the conventional binary balance Gold codes for an asynchronous CDMA system.

The problem of detecting the Optimal Spreading Codes (OSC) in a given code set for a Direct Sequence-Code Division Multiple Access (DS-CDMA) system that employs de-spreading sequences weighted by adjustable chip waveforms has been described in [7]. Due to computational complexity required to detect the OSC in a code set, a simple and efficient strategy has been introduced. Analysis of numerical results show that the proposed strategy can successfully distinguish the spreading codes being most suitable references for a given code set in which the candidate spreading codes have equal cross correlation properties.

Wu and Nassar et al. [8] proposed a set of novel complex spreading codes called Carrier Interferometry (CI) codes and described how these novel orthogonal spreading codes achieved cross-correlations independent of the phase offsets between different paths after transmission over a multi-path fading channel. This improved cross-correlation property relative to Walsh codes leads to higher Signal to Interference Ratio (SIR) in the DS-CDMA RAKE receiver, and, as a direct result, better performance in terms of probability of error had achieved.

Minimum auto correlation codes have been proposed in order to minimize the average magnitude of auto correlation with impulsive peak between spreading codes thereby minimizing the effect of ISI. It is shown that these codes have better average magnitude of auto correlation than Hadamard codes [9]. For example, for codes of lengths 8 and 16 the achievement in gain was 408% and 530% respectively at one shift. The generation of minimum cross correlation spreading codes has been suggested in [10] in order to minimize the magnitude of cross correlation between different spreading codes. The average magnitude of cross correlation of the proposed code has been compared with that of Hadamard and Gold codes, and a noticeable enhancement over Hadamard and Gold codes has been achieved. In [11], minimum correlation spreading codes are presented in order to minimize the magnitude of auto correlation and cross correlation between spreading codes other than zero shift. The disadvantage of the work described in [9]-[11] is that each of them produces N-1 number of spreading codes for a N length sequence which is less than Walsh code.

Generating orthogonal code sets of sequences with good correlation properties was developed by Donelan and Farrell in [12]. In this paper, an orthogonal code set has been defined as a collection of N number of sequences, each of length N, which are mutually orthogonal. For N-length code (N-1) the number of such code sets has been generated, each containing N number of orthogonal codes. Finally, N × (N-1) number of Orthogonal Gold codes have been produced. The peak cross-correlation values between the generated codes for various set sizes have also been measured. The measurement results indicate that the peak cross-correlation value improves for sets of size 32 and above, as the maximum value is less than half of the sequence.

In order to generate a new family of orthogonal code sets that can be employed as a spreading sequence in a DS-CDMA communication system, a small set of Kasami sequence has been utilized [13].The algorithm described in this paper is capable of providing more number of distinct codes than the popularly used Walsh

code in CDMA system. The BER performance of the proposed code along with different orthogonal codes has been studied under multiuser scenario.

New sets of Walsh-like nonlinear phase orthogonal codes for synchronous and asynchronous CDMA communication system has been proposed in [14]. It has been directed that the proposed code outperforms Walsh code and their performances closely match with the nearly orthogonal Gold codes in AWGN channel with more number of codes than Walsh code. It has also been mentioned that the performances of all the binary codes are comparable to each other in Rayleigh flat-fading channels.

In this paper, a novel orthogonal minimum correlation spreading code has been proposed. The performance of the proposed code has been studied and compared with other existing codes in terms of various attributes, like number of generated codes, cross correlation and auto correlation values. To study the BER performance of the generated code, SIMULINK based downlink CDMA system model has been used. This paper is structured as follows: section 2 discusses about the various factors affecting the choice of spreading code; section 3 includes the mathematical background of spreading codes; the proposed algorithm has been presented in section 4; section 5 incorporates simulation results and its analysis; section 6 finally places some concluding remarks on this work and also some future scope of this work.

2. Factor Affecting the Choice of Spreading Code

There are many factors affecting the choice of spreading code namely cross correlation, auto correlation, length of code set and peak to average power ratio. However, in this paper correlation property is discussed in detail. Auto correlation [19] is a measure of the similarity between a code c (n) and its time shifted version. Mathematically it is defined as:

$$r_{cc}(l) = \sum_{n=-\infty}^{\infty} c(n) * c(n-l) \qquad where, l = 0, \pm 1, \pm 2 \cdots \tag{1}$$

Auto correlation function must be impulsive peak at zero time shifts and minimum values at all other shifts. It is essential at receiver side to differentiate the desired user from other users producing MAI. Thus, spreading code should be generated such that it gives maximum autocorrelation value at zero shifts and minimum other than at zero shifts. For example, Pseudo-Noise (PN) sequence generated using Linear Feedback Shift Register (LFSR) possess ideal impulsive auto correlation characteristic. But due to non orthogonality of the PN code its cross correlation property is not suitable for CDMA system. So spreading code for CDMA system should be generated in such a way that its Auto Correlation Function (ACF) must be impulsive in nature while maintaining minimum Cross Correlation Function (CCF) among them.

Cross correlation [19]-[20] is a measure of similarity of two waveforms as a function of time lag applied to one of them. In order to appreciate the relationship between MAI and cross correlation properties between spreading codes, let's investigate a simple CDMA system. Assume there are N synchronous users, the channel is single-path, users transmit at unity amplitude, and there is no phase shift between the signals. The uplink baseband received signal at any particular bit interval can be written as [4]

$$r(t) = \sum_{i=1}^{N} h_i d_i s_i(t) + n(t) \tag{2}$$

Where, N is no of users, si(t), di, hi, are spreading code, transmitted data bit and gain of ith user respectively in the CDMA system, and n(t) represent system noise. By using correlator the output of ith user can be represented by equation given below

$$y_i = h_i d_i + \int n(t) s_i(t) dt \sum_{k=1, k \neq 1}^{N} h_k d_k \int s_k(t) s_i(t) dt$$

(3)

It is obvious that yi is composed of three components: desired signal hi.di, noise effect, $\int n(t) s_i(t) dt$ and MAI for the ith user, $\sum_{k=1, k \neq 1}^{N} h_k d_k \int s_k(t) s_i(t) dt$. If cross correlation relation between spreading code of ith user and all other users, $\int s_k(t) s_i(t) dt$ is zero then the ith user will not have a MAI term in yi. But in multiuser system MAI quantity must be minimized as it is not possible to generate codes with zero cross correlation value.

3. Mathematical Background of Spreading Code

3.1. Walsh-Hadamard Codes

Walsh Hadamard code generates orthogonal spreading codes for multicarrier CDMA system. Orthogonal codes avoid Multiple Access Interference under perfect synchronization. These functions are generated by [3] mapping codeword rows of a special square matrix called Hadamard matrix. So N length Walsh code can offer N number of codes which can assist maximum N number of CDMA users,and that can be generated by a standard repetative procedure:

$$W_I = [0], \quad W_2 = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}, \quad W_4 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \text{ and } W_{2N} = \begin{bmatrix} W_N & W_N \\ W_N & \overline{W_N} \end{bmatrix}$$

Here Walsh matrix contain first row of all zeros and the next rows have equal number of ones and zeros. N is a power of 2 and over score implies the binary complement of corresponding bits in the matrix. Each row of the matrix represent a Walsh code by mapping 0 to 1 and 1 to -1. So these generated codes are orthogonal and between any pair cross-correlation value is zero.

3.2. Gold Codes

Gold sequence can generate huge number of codes just by employing two simple functions shift and module-2 addition. The sequence is choosen from set of codes whose cross correlation between the code is uniform and bounded [15] [16] [17]. Actually, the entire set of these codes are generated by modifying orginal Gold codes generated by preferred pair of maximal PN sequences. The family of orginal Gold codes is defined by {a, a′, a+Da′ …a+DN-1a′}, where a, a′ represent a preferred pair of m-sequences each having a period N=2n-1, and D is a delay element.

3.3. Kasami Sequences

Kasami sequences generate a binary sequence with very small cross correlation value. Kasami sequence clasify as large and small set of sequence.the large set contain all the sequence of small set. Small set kasami sequence[3] [18] generates 2n/2 no of binary sequences of length N=2n-1. A shift register is used to generate a PN sequence with 'n' no of flipflops, where n is even and positive number. For any N length of PN sequence, m1 is first generated. By decimating m1 by 2n/2+1 number of bits, another PN sequence m2 of period 2n/2-1 has been genrated. By performing modulo-2 addition between the bits of the sequence m1 and those of m2 and including the orginal PN sequence m1 in the above sequence set, altogther 2n/2 number of binary sequences has been produced.

3.4. Minimum Correlation Spreading Code

A minimum correlation spreading code is a code that minimizes average magnitude of auto correlation values except zero time shift and minimizes the average value of cross correlation [11] simultaneously. For minimum auto correlation, let's assume we have a spreading code, s, of length N, which can be represented as [X1, X2... XN-1, XN] T, where T is the transpose operator. It is required to obtained the following for minimum autocorellation

$$
\begin{bmatrix}
X_1 & X_2 \ldots\ldots\ldots\ldots\ldots & X_N \\
0 & X_1 \ldots\ldots\ldots\ldots\ldots & X_{N-1} \\
. & . & . \\
. & . & . \\
. & . & . \\
0 & 0 \ldots\ldots\ldots\ldots\ldots & X_1
\end{bmatrix}
*
\begin{bmatrix}
X_1 \\
X_2 \\
. \\
. \\
. \\
X_N
\end{bmatrix}
=
\begin{bmatrix}
1 \\
min \\
. \\
. \\
. \\
min
\end{bmatrix}
\tag{4}
$$

This is equivalent to minimization of function

$$G_1 = \mathbf{s^T . E . s,} \tag{5}$$
such that $\mathbf{s^T . s = 1}$.

Here, the eigenvector of a symmetric and rank 1 matrix, Ra gives minimum autocorelation spreading code in the following relation Ra=E, where E is a (N×N) matrix with all element one.

In minimum cross correlation code the objective is to minimize the cross correlation values with a known spreading code. For this let us assume a spreading code, x, of length N, then find a code s that minimize the average magnitude of cross correlation. Where x and s can be represented as [X1 X2..................... XN] T and [Y1, Y2..................... YN] T, respectively. For minimum cross-correlation code it is required to obtain

$$
\begin{bmatrix}
X_1 & X_2 \ldots\ldots\ldots\ldots\ldots & X_N \\
0 & X_1 \ldots\ldots\ldots\ldots\ldots & X_{N-1} \\
. & . & . \\
. & . & . \\
. & . & . \\
0 & 0 \ldots\ldots\ldots\ldots\ldots & X_1
\end{bmatrix}
*
\begin{bmatrix}
Y_1 \\
Y_2 \\
. \\
. \\
. \\
Y_N
\end{bmatrix}
=
\begin{bmatrix}
min_1 \\
min_2 \\
. \\
. \\
. \\
min_N
\end{bmatrix}
\tag{6}
$$

To achive minimum cross correlation equation 6 can be formulated by minimizing the function

$$G_2 = \mathbf{(x^T . E . s)^T . (x^T . E . s),} \tag{7}$$

such that $\mathbf{s^T}.\ \mathbf{s}=1$.

In this case the eigenvector of a symmetric and rank 1 matrix Rc gives minimum autocorelation spreading code in the following relation Rc=E.x.xT.ET.

In minimum correlation spreading we explore the idea of merging both Minimum Auto Correlation Code and Minimum Cross Correlation Code problems into a single problem. So we represent our optimization problem as

Minimize $G_1=\mathbf{s^T}.\ \mathbf{E.\ s}$
Minimize $G_2=(\mathbf{x^T}.\ \mathbf{E}.\ \mathbf{s})^\mathbf{T}.(\ \mathbf{x^T}.\ \mathbf{E}\ .\ \mathbf{s})$ (8)
such that $\mathbf{s^T}.\ \mathbf{s}=1$

this can be written by a single crirerion minimization function using convex optimization as:

Minimize $G=K.\ \mathbf{s^T}.\ \mathbf{E.\ s} + (1\text{-}K).\ (\mathbf{x^T}.\ \mathbf{E}\ .\ \mathbf{s})^\mathbf{T}.(\ \mathbf{x^T}.\ \mathbf{E}\ .\ \mathbf{s})$ (9)
such that $\mathbf{s^T}.\ \mathbf{s}=1$
where $0 \leq K \leq 1$

Finally $\mathbf{R}=K \times \mathbf{E} + (1\text{-}K)\ \times\ (\mathbf{E.x.x^T.E^T})$ produces eigenvector of a symmetric and rank 1 matrix for minimum corelation spreading code.
Here, $\mathbf{R}$ generates *N-1* number of eigenvector of zero eigenvalues which are orthogonal to each other.

4. Proposed Algorithm

The proposed algorithm for generation of orthogonal code for CDMA system has been described below:

*STEP 1:*Take any row of Walsh matrix W_N as spreading code of length *N* except all zeros
*STEP 2:*Create a matrix X of size (N×N), whose first column is generated from the above step and all other columns are found by shifting the previous column by 1 bit position
*STEP 3:*Create a matrix E of size (N×N) by taking all the elements equal to 1
*STEP 4:*Multiply E with each column vector of X and obtain a column vector of size (N×1). Thus N number of (N×1) column vectors are generated. Arrange all column vectors to generate a matrix A of size (N×N).

Generate the matrix B where B=Transpose (A)

*STEP 5:*Evaluate Ri = K. ET + (1-K). Aci. Bri, Where, K is scalar quantity between 0 and 1, ci and ri are ith column and ith row of matrices A and B respectively. i takes the value from 1 to N. Thus N number of N ×N symmetric matrices is generated
*STEP 6:*Generate eigenvalues and corresponding eigenvectors of Ri
*STEP 7:*For each matrix Ri, (N-1) number of zero eigenvalues and one non-zero eigenvalue have been generated. The corresponding eigenvectors of (N-1) number of zero eigenvalues are mutually orthogonal to each other
STEP 8: Finally, for N length code, N×(N-1) number of orthogonal codes are generated

5. Simulation Results

In this section, the simulation results are presented to compare performance of proposed OMCSC with the existing codes in terms of number of a number of factors, like code generation, correlation values and Bit Error

Rate (BER) performances. For OMCSC code, N numbers of N×N matrices have been generated. Next, the eigenvalues associated with these matrices have been found out. It has been observed that N-1 no. of zero eigenvalues and one nonzero eigenvalue exist for each N×N matrix. In this way, for all N×N matrices, N×(N – 1) number of zero eigenvalues and N number of nonzero eigenvalues are evaluated. The eigenvector associated with these zero eigenvalues are found to be unique and orthogonal. To select the proper value of "K" in the minimization function as described by equation (9), the magnitude of minimization function has been plotted with respect to the value of "K" and presented in Fig. 1. It is evident that the optimum value of "K" is 0.20 at which the minimization function attains its minimum value i.e. both the magnitudes of auto correlation and cross correlation become minimum.
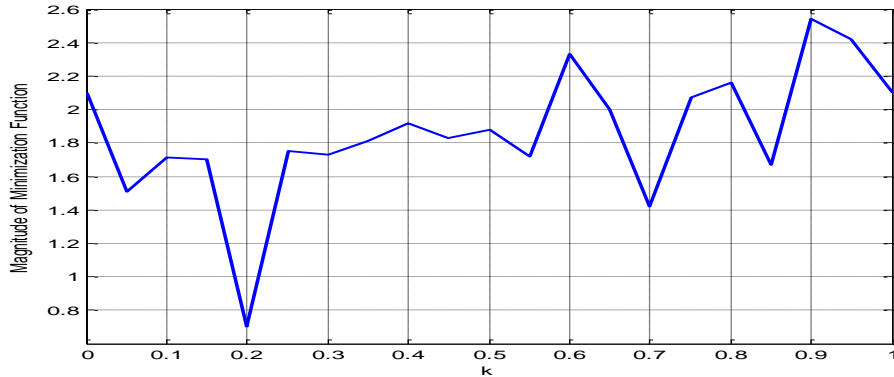

Fig.1 Plot of Minimization Function vs. K for code length of 16

5.1. Number of Codes

The proposed OMCSC algorithm generates large number of codes in comparison with existing codes like Walsh code and orthogonal Kasami code. For a given code of length N, proposed code generates N×(N – 1) number of distinct codes whereas Walsh code gives N and orthogonal small set Kasami code give sqrt(N)×(N-1) number of distinct code. The detail comparison of proposed code and existing codes is shown in Table 1. From this it is clear that the proposed orthogonal MCSC algorithm outperforms the other code generation algorithms by providing a large number of users in a CDMA system.

Table 1. No of code members of different orthogonal codes for a fixed length code.

Length of the Code	Number of distinct code members			
	Walsh	Orthogonal Gold code	Orthogonal small set Kasami	Orthogonal proposed MCCSC
4	4	12	6	12
16	16	240	60	240
64	64	4032	504	4032
256	256	65280	4080	65280

5.2. Correlation Property

The average magnitudes of cross-correlation of the proposed code along with other existing codes have been presented in Fig.2. It is observed that the proposed spreading code gives zero cross correlation value at zero

time shift which is an indication of maintaining orthogonality by the code. In contrast, other codes offer quite high magnitude of cross-correlation as compared to the proposed code. Hence it can be claimed that the proposed code can handle the effect of MAI in a better way than the other codes.
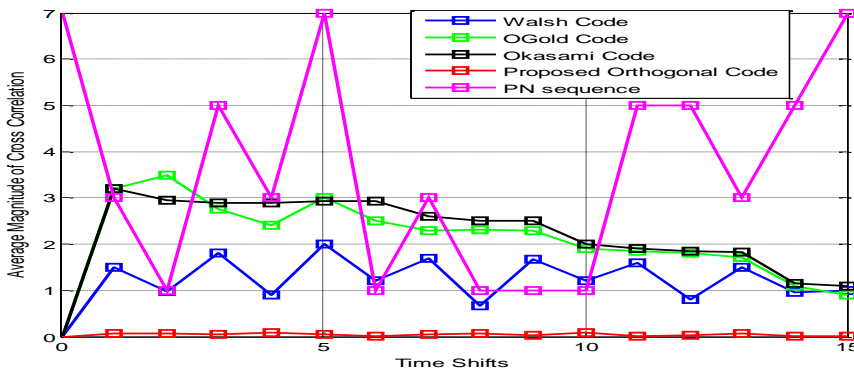

Fig.2 Comparison Based on Average Magnitude of Cross-correlation

The average magnitude of auto correlation of proposed OMCSC and existing codes are shown in Fig. 3. For this purpose, the average magnitude of auto correlation has been normalized to 1 in all the cases. From this Fig., it has been observed that our proposed code offers impulsive peak at zero time shift. Moreover, the average magnitude of the side lobes is low as compared to others. It is obvious from Fig. 3 that, except PN sequence, other existing codes are much inferior to the proposed code.
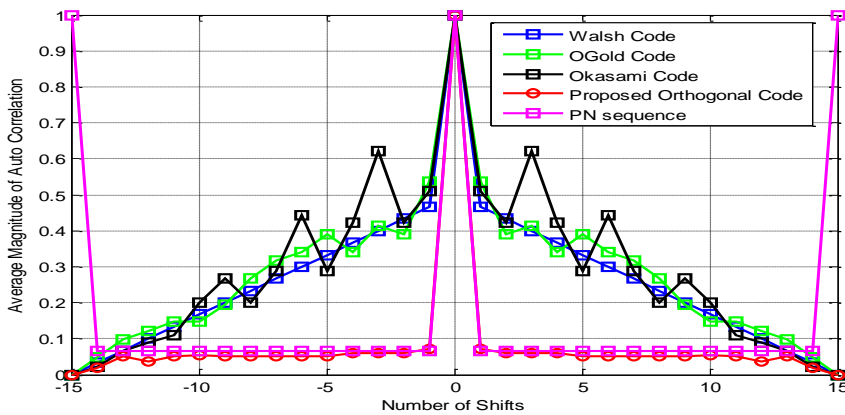

Fig.3 Comparison Based on Average Magnitude of Auto-correlation.

The ratio of peak autocorrelation to other shift autocorrelation (α) has been demonstrated in Table 2. and the corresponding simulation result has been illustrated in Fig. 4. Likewise, the ratio of cross correlation to autocorrelation (β) has been presented in Table 3.with the respective simulation result in Fig. 5.

A high value of α and a low value of β is favourable for a good spreading code. The proposed OMSSC code possesses a high value of α as depicted in table 2 and Fig. 4 which consequently minimises the effect of ISI and thus reduces the chances of false synchronization at the receiver. Also, it has a low value of β as illustrated in Table 3 and Fig.5. This minimum value of β suggests that the proposed code can handle the effect of MAI in a

better way than the existing spreading codes.

Table 2. Ratio of peak autocorrelation to other shift autocorrelation (α)

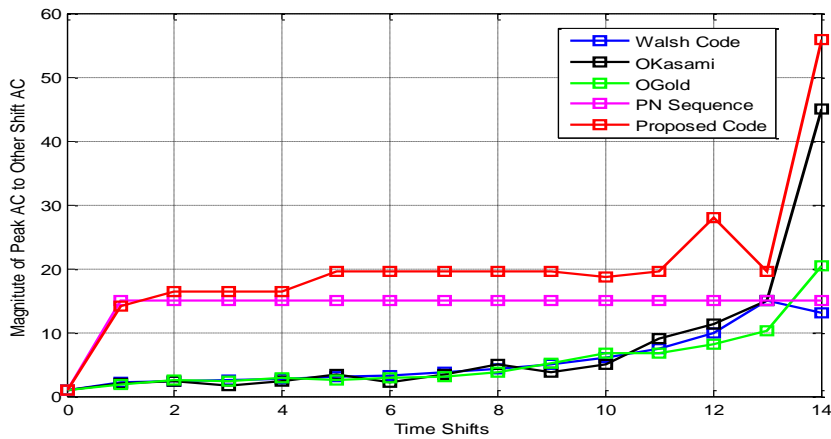| Name of code	Ratio of peak autocorrelation to other shift autocorrelation shifts→														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Walsh	1	2.14	2.30	2.50	2.72	3.00	3.33	3.74	4.28	5.00	5.99	7.50	10.00	14.99	13.03
OKasami	1	1.95	2.36	1.60	2.36	3.46	2.25	3.46	5.00	3.75	5.00	9.00	11.24	14.99	45.05
OGold	1	1.86	2.56	2.41	2.92	2.56	2.92	3.1	3.72	5.12	6.83	6.83	8.19	10.24	20.49
PN Seq.	1	15.00	15.00	15	15	15	15	15	15	15	15	15	15	15	15
Purposed code	1	14.08	16.39	16.39	16.39	19.53	19.53	19.53	19.53	19.53	18.65	19.53	28.01	19.53	55.86

Fig.4 Comparison Based on Ratio of peak autocorrelation to other shift autocorrelation.

Table 3. Ratio of auto-correlation to cross-correlation (β)

| Name of the code	Ratio of Cross-correlation to Auto-correlation(β) shifts→														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Walsh	0	3.21	2.23	4.50	2.45	6.00	4	6.37	2.87	8.40	7.19	12.00	8.00	22.89	28.52
OKasami	0	6.21	6.98	4.66	6.86	10.10	6.57	8.99	12.50	9.37	10.00	17.10	20.87	27.45	52.21
OGold	0	5.96	8.96	6.63	7.02	7.68	7.32	7.25	8.64	11.78	12.98	12.64	14.75	17.63	22.54
PN Seq.	0.4	3	1	5	3	7	1	3	1	1	1	5	5	3	5
Purposed code	0	0.98	1.05	0.92	1.33	0.95	0.01	0.85	1.21	0.49	1.62	0.25	0.85	1.50	0.73
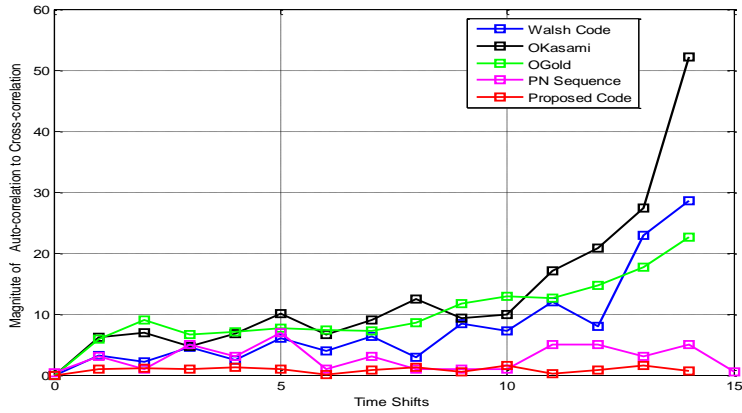
Fig.5 Comparison Based on Ratio Cross- correlation to Auto-correlation.

5.3. Bit Error Rate Performance

BER performance evaluation of proposed OMCSC has been carried out using Additive White Gaussian Noise (AWGN) channel under multiuser scenario. For this purpose, SIMULINK-based downlink CDMA system model has been used and the BER value of such system was also measured. One such model for two-user is shown in Fig.6.
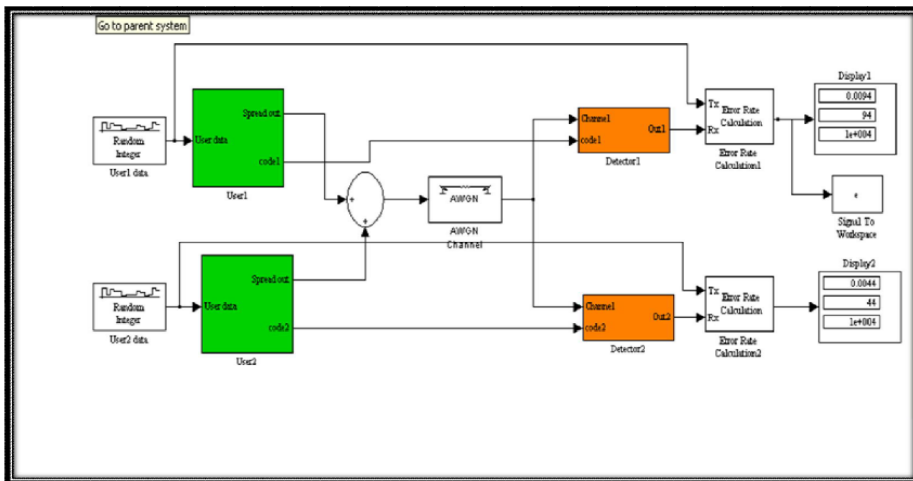

Fig.6. Simulation model of CDMA based downlink system for two-user scenario.

The SNR verses BER plots have been shown in Fig. 7, 8 and 9 for 8, 10 and 12 users respectively. For the purpose of comparison, the BER performances of three existing spreading codes have also been included in this study.
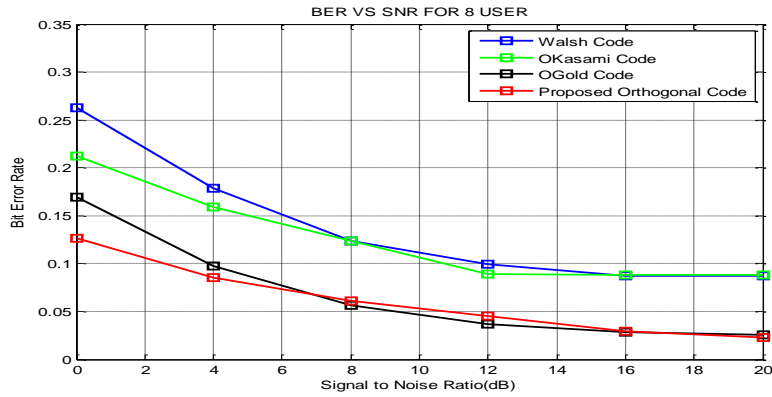
Fig.7 Comparison of BER performances for synchronous downlink communication under 8 user scenario in AWGN channel
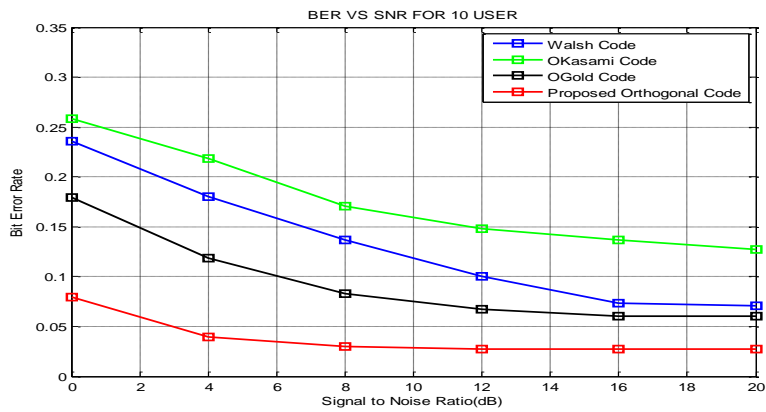

Fig.8 Comparison of BER performances for synchronous downlink communication under 10 user scenario in AWGN channel
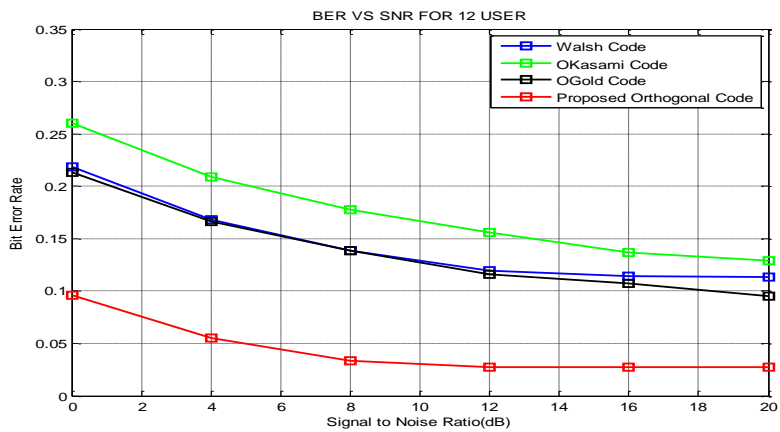

Fig.9 Comparison of BER performances for synchronous downlink communication under 12 user scenario in AWGN channel

Fig. 10 and 11 describe the effect of number of users on BER performance of synchronous multiuser CDMA system using proposed OMCSC and existing codes for 12 dB and 20 dB SNR value respectively.
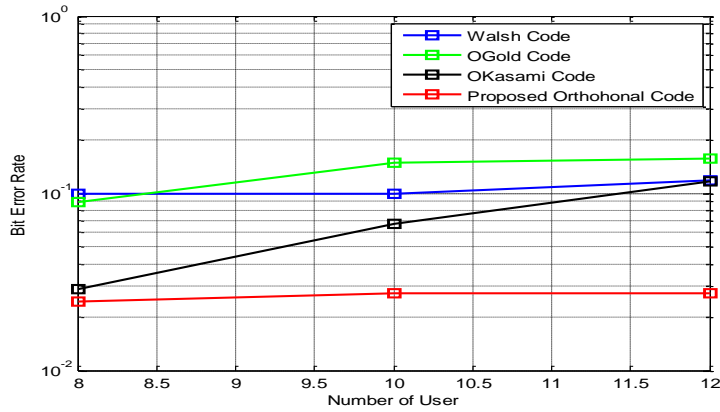

Fig.10 Multiuser BER performance for synchronous downlink communication under AWGN channel at SNR = 12dB
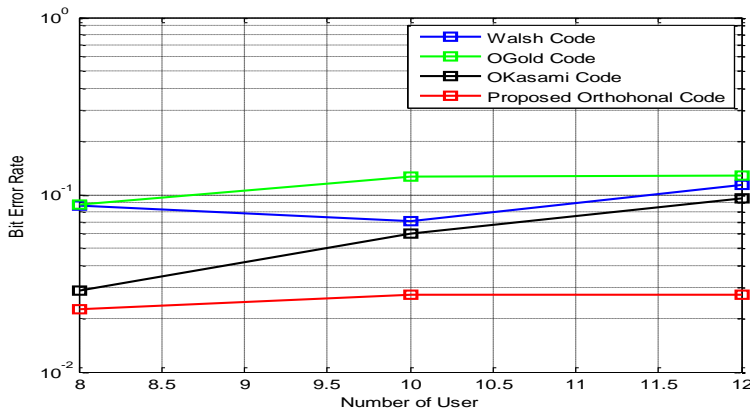

Fig.11 Multiuser BER performance for synchronous downlink communication under AWGN channel at SNR = 20dB

Table 4 and table 5 also illustrates the BER performances for different users of various spreading code like Walsh, Orthogonal Kasami, Orthogonal Gold and OMCSC code.

Table 4. BER Performances at 12dB for Different User

. No. of user	Walsh code BER	Orthogonal Kasami BER	Orthogonal Gold BER	OMCSC Code BER
8	0.0997	0.0289	0.0887	0.0449
10	0.1000	0.0672	0.1482	0.0273
12	0.1191	0.1162	0.1561	0.0271

Table 5. BER Performances at 20dB for Different User

	Walsh code	Orthogonal Kasami	Orthogonal Gold	OMCSC Code
No. of user	BER	BER	BER	BER
8	0.0871	0.0286	0.0884	0.0227
10	0.0712	0.0602	0.1273	0.0273
12	0.1136	0.0953	0.1286	0.0271

A close inspection of the above Fig. and tables reveals the fact that the proposed orthogonal code offers a lower value of BER irrespective of the number of users. Whereas, the degradation in the performance of the other codes is considerable with the increase in number of users. Hence the proposed code also outperforms the others in this respect.

6. Conclusion

In a CDMA system availability of more number of codes, minimum magnitude of cross correlation, impulsive peak auto correlation and BER performance plays a major role. So Code designer have to generate spreading code such that it support more number of user, good auto-correlation property, good BER performance with better cross-correlation property which eliminate undesirable effect like ISI, MAI by reducing the chance of false synchronisation. This paper present one algorithm to generate "a novel orthogonal minimum correlation spreading code" which offer a large number of codes in comparison to other existing code like Walsh code and OKasami code with better auto and cross correlation property. Also the BER performance of proposed OMCSC is suitable in AWGN channel with multiuser scenario. Hence we concluded that purposed OMCSC outperform other existing code and give one optimum solution for future CDMA communication system.

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