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Performance Analysis of Selective Mapping and Clipping based MC-CDMA System

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Abstract: ***The use of orthogonal frequency division multiplexing in high-bit-rate communication systems is appealing. Due to its fast data rate, resilience to delay spread, frequency spectrum efficiency, and other features, it has been widely utilised in current wireless communication. In addition to these benefits, a significant disadvantage of OFDM is the high Peak-to-average-power ratio (PAPR) of the transmitter's output signal, which limits the system's performance. The Iterative Clipping and Filtering (ICF) approach is used in this case because it yields better results than the Clipping method, which is the easiest way to lower the PAPR of the OFDM system. Another strategy that effectively reduces PAPR is selective mapping (SLM), in which the actual transmit signal is chosen from a list of candidates.***
Keywords: CDMA, MC-CDMA, OFDM, PAPR.

I. INTRODUCTION

It's constantly desirable in wireless communication systems to enable subscribers to coincidently submit information from the mobile station to the base station and admit information from the base station to the mobile station. Any given area is divided into cells by a cellular system, and mobile units in each cell connect with base stations. The primary thing of cellular system design is to be suitable to ameliorate the channel's capacity or to handle as numerous calls as doable with a given bandwidth while maintaining an acceptable degree of service quality. The channel can be made accessible in a variety of ways.

Over the once ten times, there has been a lot of attention paid to the issue of Peak- to-Average Power rate(PAPR) reduction in Orthogonal Frequency Division Multiplexing(OFDM) systems, which has redounded in the development of numerous PAPR reduction strategies. The so - called" picky Mapping" algorithm would be a largely successful system for reducing PAPR. In this study, we suggest a modified trimming system and combine it with picky mapping to reduce PAPR. The proposed fashion can reduce PAPR more effectively than the traditional ways, according to simulation data.

A major hedge to the MC- CDMA system is a high PAPR. Named Mapping (SLM) is a useful fashion for MC- CDMA signal PAPR reduction. What sequence is named as the phase sequence in SLM is one which causes PAPR infection most directly. In this paper, the simulations of the PAPR performance and BER performance are handed. According to the findings of the inquiry, the proposed sequence is superior to the Walsh - Hadamard for MC- CDMA system PAPR reduction. According to the suggested order, the MC- CDMA system performs better than anticipated, as demonstrated by the simulation of the system's BER performance wind.

II. LITERATURE SURVEY

CDMA is one of the cellular communication method. It is efficient technique [1].Compared to single carrier systems multiple carrier system provides better results, because of interference cancelation capability. Because the wideband frequency is converted into narrow band frequencies. So the 3G single carrier CDMA system is added with advanced technology that is OFDM which consists of multiple carriers leads to MC-CDMA technology [2],[3]. It is a 4G component and beyond also. Spreading codes plays vital role in spread spectrum systems [4],[5]. PAPR is a major issue in multi carrier systems. Several PAPR decreasing techniques available in literature [6-10].

III. SYSTEM MODEL

Picky mapping(SLM), a system of PAPR reduction, is effective and simple. Since SLM is a direct procedure, the signal isn't destroyed. At the receiver, the signal can be completely demodulated. Still, SLM suffers from a high computational cost issue. In this exploration, we thus offer a modified SLM. The system, known as a SLM-Clipping, significantly reduce computational complexity while offering similar PAPR reduction performance to the traditional SLM system. The simulation results demonstrate that it performs more effectively than the traditional SLM.

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A particularly promising system for the fourth generation of mobile communication systems is multicarrier law division multiple access(MC- CDMA), which is grounded on the combined scheme of CDMA and OFDM.

A. Implementation of SLM based System

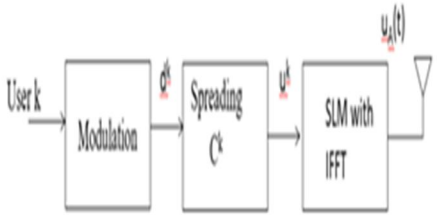


Figure 1: MC-CDMA using SLM

STEP 1: User data d(k) bits is generated.
STEP 2: Modulate the generated data using phase shift keying (PSK) modulation.
STEP 3: The complex-valued data symbol rate is 1/Td.
STEP 4: The obtained data after modulation is spread using the Golay spreading sequence
STEP 5: The obtained data after spreading is given by S=dc.
STEP 6: Then the data symbols are mapped using Mapping block and IFFT operation is performed.
STEP 7: The multiplication of different phases to the data obtained after spreading i.e to S^(k)=d^(k)*c ^(k) is done in selective mapping.
STEP 8: Then PAPR is calculated for the obtained data.
STEP 9: The least PAPR signal from the total obtained signals is selected and transmitted.
The MC- CDMA symbol's PAPR description is indicated as follows.

$$PAPR(dB) = 10\log_{10}\frac{\max|s(t)|^2}{E[|s(t)|^2]} \qquad \text{-------(1)}$$

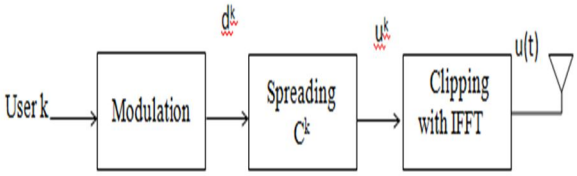


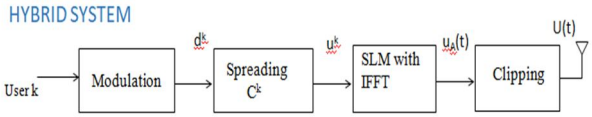
Fig: Transmitter model of Clipping method

$$CL=\begin{cases} u_A(t), & |u_A(t)| \le A \\ A, & |u_A(t)| > A \end{cases}$$

Figure 2: MC-CDMA using Clipping

B. Implementation of CLIPPING based System
STEP 1: The sub carrier which has maximum amplitude is taken and kept as threshold.
STEP 2: The data Then PAPR is calculated to the data obtained X= 0.75*(Selective mapping data).
STEP 3: If the obtained data is below the threshold level then it's is taken & if it is above the threshold level the data is clipped and set to the threshold level.
U(t)={u(t),|u(t)<A|}
where A is the threshold.

C. Implementation of Hybrid System



Transmitter model of Hybrid system

$$C^k=(c_0^k,c_1^k,\ldots\ldots\ldots c_{L-1}^k)^T$$

$$u^k=d*c$$

$$u^k=d^kc^k=(s_0^k,s_1^k,\ldots\ldots s_{L-1}^k)^T$$

STEP 1: The peak amplitude from the selective mapping technique obtained data is taken and then clipped to 75% of that data.
STEP 2: Then PAPR is calculated to the data obtained X= 0.75*(Selective mapping data).
STEP 3: If the obtained data is below the threshold level then it's is taken & if it is above the threshold level the data is clipped and set to the threshold level.

IV. RESULTS

The simulation results are shown below. Number of users are 4 and modulation used is BPSK. Golay sequence is used for spreading. Rayleigh channel used. Matlab is used for simulation.

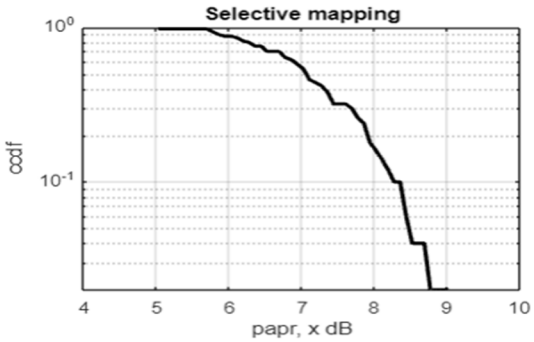


Figure 3: PAPR performance of SLM based system

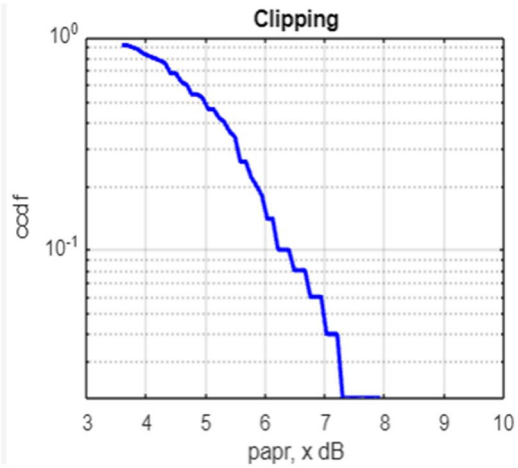


Figure 4: PAPR performance of Clipping based system

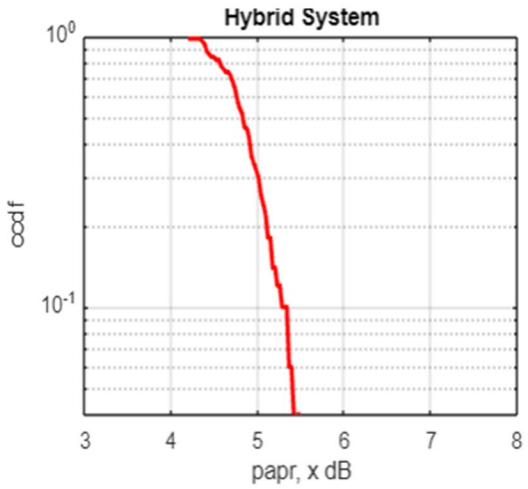


Figure 5: PAPR performance of hybrid system

The above graph shows the PAPR performance of hybrid MC CDMA system.

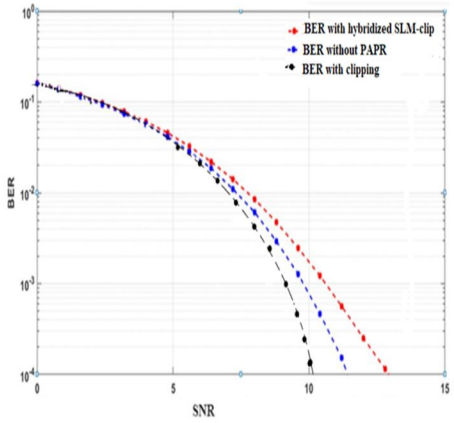


Figure 6: BER performance comparison

The attained PAPR value for the MC-CDMA system for the hybrid system, which is the combination of picky mapping and trimming, is 5.4. The figure displays the simulation results of the PAPR reduction strategy of the MC- CDMA system. Compared to the trimming, the proposed fashion greatly reduces PAPR.

Table 1:Comparision Table

Techniques	PAPR	CCDF
MC-CDMA	9.8	10^{-1}
Selective Mapping	8.9	10^{-1}
Clipping	7.2	10^{-1}
Hybrid system	5.4	10^{-1}

V. CONCLUSION

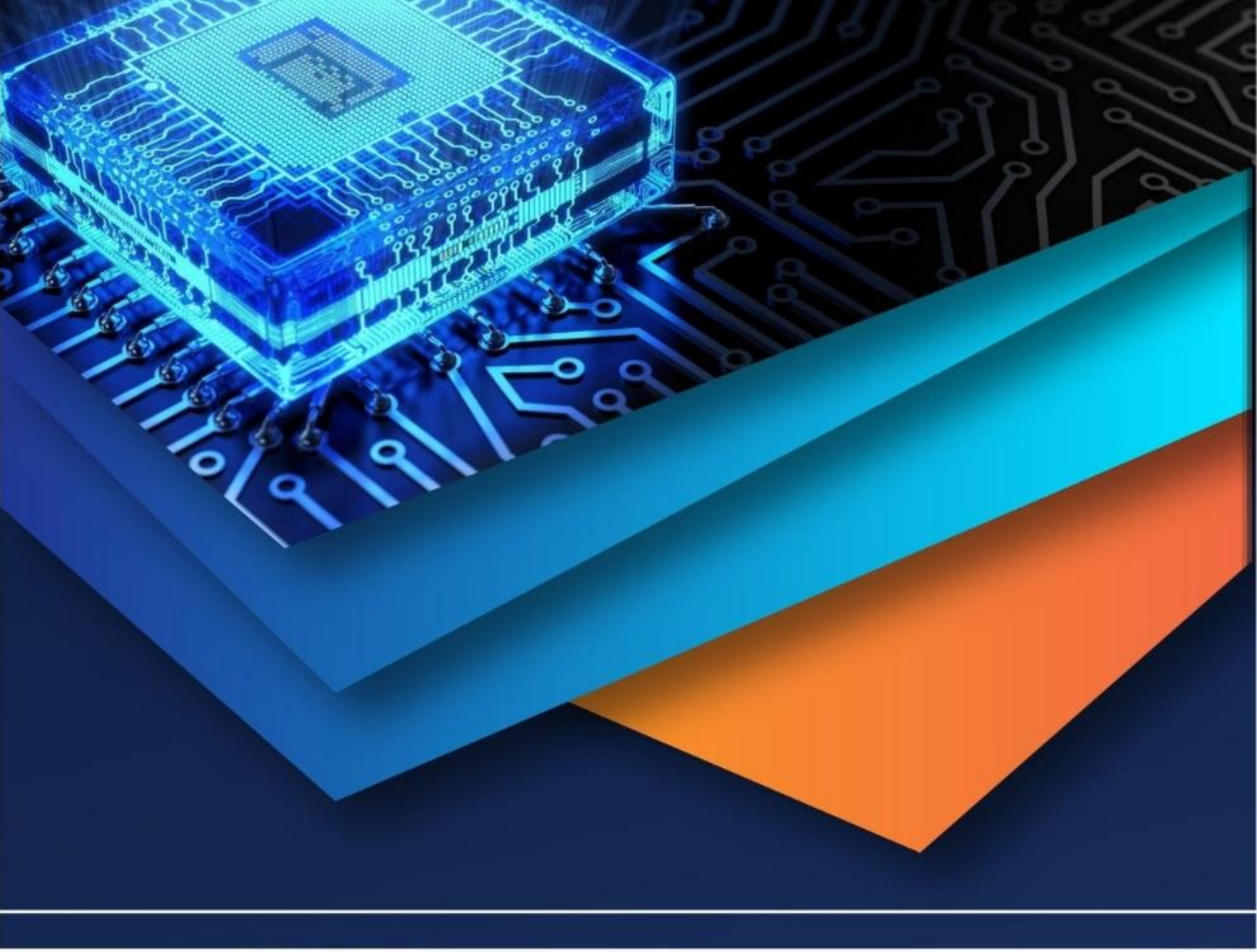
In this study, the hybrid scheme's PAPR has been examined. The proposed hybrid approach greatly reduces PAPR compared to using clipping and SLM alone, at the cost of increased BER. Additionally, it has been researched how clipping affects BER performance. By raising the clipping level, BER performance can be enhanced.

For LTE, broadband wireless networks, and personal communication beyond 4G, MC CDMA is a particularly alluring solution. In this essay, PAPR reduction strategies for multicarrier modulation transmission systems are discussed. Most of them have the ability to lower PAPR, but at the expense of slower data rates, higher transmit signal powers, higher BERs, and more sophisticated computations.

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