International Journal of Research
Available at
https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

A Novel PAPR Reduction Technique by SUI Modeling for DHT Based ACO-OFDM

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Abstract

In this work we first developed a system for optical wireless communication to get the better results compared to existing state of art techniques with the use of DHT based ACO-OFDM method. As OFDM comes under the development of all recent techniques under LTE. But, this OFDM is having numerous applications and advantages. The main drawback of OFDM is PAPR (peak to average power ratio), which is nothing but non-linear distortions present in system before transmission. SUI modeling for DHT based PAPR reduction using DHT-spreading techniques is proposed in this work which yields better results than DHT based PAPR reduction existing state of art techniques effective equalization and better transmission performance are the main reason behind proposed work and achieved low PAPR over traditional state of art PAPR reduction techniques. Proposed work with SUI modeling will give us better results compared to state of art existing technique.

Keywords: *ACO-OFDM, OFDM, AWGN channel, DHT, PAPR, SUI modeling, (IM/DD) systems*

I. INTRODUCTION

It is necessary to appreciate that optical communications isn't like electronic communications. Whereas it appears fiber very similar to electricity will during a wire this is often very dishonorable. Lightweight may be a radiation and optical fiber is a conductor. Everything to try to to with transport of the signal even to straightforward things like coupling (joining) 2 fibers into one is extremely totally different from what happens within the electronic world.

The 2 fields (electronics and optics) whereas closely connected use totally different principles in numerous ways that. There is we developed DHT based OFDM system for which there is no need to give Hermitian Symmetry (HS) so that again there is reduction in complexity because the same model algorithm of DHT based OFDM system may be used for the both reasons as multiplexing and de-multiplexing processing purpose. When recent technique based on DHT based ACO OFDM model having same size as previous DFT based ACO OFDM system but the 2-PAM (pulse amplitude modulation) in DHT based ACO OFDM transmit the same bits as we previously transmitted in DFT based ACO OFDM system using QPSK system as well as we also having BER performance somewhat similar in both the system.

In OFDM system we've got such a small amount of drawbacks however we have a tendency to area unit aiming to take into account the PAPR that in the main degrades the performance the OFDM system owing to amplitude distortion in electronic also as optical domain. As ACO OFDM having additional PAPR than as compare to easy OFDM as a result of the height power are going to be an equivalent however average power within the ACO OFDM is reduced, thus analysis is needed to scale back the PAPR in ACO OFDM. Investigator researched between these 2 techniques however they got that the results for DHT primarily based ACO OFDM area unit higher.

So in this paper SUI modeling for DHT spread is applied to reduce the PAPR in DHT based ACO OFDM as well as the performance of the system is given by the MATLAB experimental results. Different from DFT-spread technique those are already available in existing techniques; DHT-spread technique is having the real output, which make the system very less complicated known as DHT-based ACO-OFDM system. At fixed value of complementary cumulative distribution (CCDF) function (CCDF) of 10^{-3}, the PAPR performance as 9.7 dB and 6.2 dB lower than those of conventional existing techniques. DHT-based ACO-OFDM without DHT-spread technique for 2-PAM and 4-PAM, respectively. The proposed system has better performance of equalization which is compared with state of art previous techniques as well as the nonlinear distortion removal as compare to the existing techniques of PAPR reduction.

2. Optical Wireless Communication

Light is having very high speed compared to any other sources of transmission. Light could be a resource accustomed understand content by human sensory system in well outlined manner. Lightweight plays an important role in human civilization from many years and antecedently lightweight acts as medium to speak in numerous applications. Heap of historical evidences proves that lightweight acts as supply of medium for communication particularly in warships and history of evidences are from biblical times to modern world. In biblical times, fireplace acts as medium for communication to offer signals concerning data concerning enemies and different connected matters.

The dominant things in optical technology is as in no time "electric wire" that is wired connection is there but data is in the form of light. Optical fibers replaced the use of wired communications systems and gives a lot of else changes that we require. Maybe this is often more or less than the ideal one but require reducing the interferences. The high speed and quality of optical communications systems are very important task in itself predicated the event of a new algorithm of electronic communications itself designed to be run on optical connections which is considered as very effective considered with other. ATM and SDH technologies are smart samples of the new technologies style of this type of systems.

It is necessary to appreciate that optical communications isn't like electronic communications because it's having more number of applications than state of art existing techniques. Whereas it appears that lightweight travels in an exceedingly fiber very similar to electricity will during a wire this is often very dishonorable. Lightweight may be a radiation and optical fiber is a conductor. Everything to try to with transport of the signal even to straightforward things like coupling (joining) 2 fibers into one is extremely totally different from what happens within the electronic world. The 2 fields (electronics and optics) whereas closely connected use totally different principles in numerous ways that.

3. Literature Survey

Nowadays, there is increase in bandwidth for different applications which is considered as effective task under consideration; together with sharing of video and music we can also use beside new rising applications like video on demand, video application work have motivated the investigation of high capability optical communication technologies due to advantages of high speed of light. Web traffic has been growing at very high speed or in large amount rate and this might attain to very high use of data level by considerations of the study in 2015. There's need to explore this study spectrally economical, price effective transmission resolution for next generation optical networks to satisfy the increased demand of web traffic. New communication trends expect price effective, versatile high performance transmission, which may be achieved by mistreatment DSP. Literature survey shows increase in interest for mistreatment DSP at receiver by researchers in recent years for providing flexibility, price potency and improvement in transmission performance for next generation photonic networks. Optical OFDM has been thought of as most probable resolution for next generation photonics networks (such as LTE) with high spectral potency and less time in information measure allocation.

The idea why we use of orthogonal frequency-division multiplexing (OFDM), as a multi-carrier transmission mistreatment closely spaced number of signals with overlapping subcarriers, that was changed mistreatment separate by Discrete Fourier transform (DFT) to get less complicated system in OFDM by Weinstein in 1971. OFDM has been wide accepted and extensively explored for wireless transmission owing to varied blessings offered by it and capability of managing inhume image interference (ISI) for sensible wireless applications in mid-1980s. The basic advantages of proposed work are studied here and the minor drawbacks are considered for evaluation due to improvement in system again we will get the high data rate and less time for transmission. The relevancy of OFDM has been 1st introduced for wired transmission in digital telephone line in 1991 whereas currently it's been base for varied sensible spaces together with native area networks, broadcasting of radio and TV globally. additionally, it exists as commonplace to numerous wireless application like wireless native space network (LAN) ,which is having distance somewhat more and speed also increased to certain level, IEEE 802.11g, IEEE802.11n, wireless personal area networks (PAN), e.g.Blutooth, IEEE 802.15.3a which is used in home for wireless transmission, wireless metropolitan area networks (MAN),e.g.Wimax 802.16e (WiMax) which is used by HTC first time, and therefore the 4G mobile communication, long-term evolution (LTE) is used recently which is having certain advantages over other systems.

Further there are two alternatives as well as DCO-OFDM for straightforward low value answer and ACO-OFDM for achieving high spectral potency has been planned in literature. Conventionally OFDM signals which are having area unit bipolar is propagated with electrical signals for transmission with high speed whereas Optical OFDM signal has to be unipolar as information is carried by intensity modulation famous known as IM/DD present in mostly optical communication. So as to make non-negative Optical OFDM varied sorts of uni-polar OFDM as well as Direct current-biased optical OFDM (DCO-OFDM) and unsymmetrical clipped optical OFDM (ACO-OFDM) has been explored. DCO-OFDM is predicated on adding DC bias to scale back and clip negative venture of signal, wherever as different answer ACO-OFDM avoids the employment of DC bias with reduced clipping noise. This can be supported unsymmetrical clipping of negative half OFDM image. Another technique supported single sideband modulation OFDM (SSB-OFDM) has been experimented on OOFDM system. AN experiment on multi gigabit CO-OOFDM has been planned in 2009 over a thousand metric linear unit SSMF fiber using 2 construction part shift keying polarization division multiplexing (QPSKPDM) subcarriers. Transmission victimization ACO-OFDM achieving spectral potency of three bit/s/Hz with sub wavelength information measure access has been explored over 600 metric linear unit long Single mode fiber (SMF).

Subcarrier allocation can be applied to improve transmission performance robustness present in OFDM. Although some parameters like Bit loading (BL), power loading (PL), Bit and power loading (BPL) are checked for performance improvement for different condition but adaptive subcarrier allocation using instantaneous channel information at transmitter side may be used for BER performance check. Different subcarriers are having different SNR almost. There is motivation to use these subcarriers effectively and allocate them according to channel state information that needs to be known at transmitter for transmission of data effectively. Such effective utilization of adaptive subcarrier allocation is not used till now in background also. Consequently, an adaptive subcarrier allocation technique is needed to develop which can efficiently utilize spectrum as per user requirement using channel state information for performance improvement.

4. PROPOSED METHODOLOGY

This implementation is given specially for multiplexing and de-multiplexing process of ACO-OFDM for IM/DD system. The N point DHT and inverse DHT is are given as below,

$$X_n = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} X_k cas\left(\frac{2\pi kn}{N}\right) \qquad X_k = \frac{1}{\sqrt{N}} \sum_{n=0}^{N-1} X_n\, cas\left(\frac{2\pi kn}{N}\right) \quad (1)$$

Where $cas(\cdot) = \cos(\cdot) + \sin(\cdot)$, n and k ranges from 0 to $N-1$,

X_n gives the time-domain OFDM sample,

X_k gives the frequency-domain input sample,

In DFT-based IM/DD OFDM signal, HS is required to come up with real signals which are not considering any imaginary signal. However in DHT-based IM/DD OFDM signal, DHT could be a real pure mathematics remodel with a self-inverse property, it mechanically generates real signal without consideration of imaginary part and therefore the multiplexing and de-multiplexing processes use constant algorithmic program for transmission and at receiver . The diagram given for DHT-spread ACO-OFDM (DHT-S-ACO-OFDM) for IM/DD system is shown in given figure.

In comparison to typical ACO-OFDM, DHT-S-ACO-OFDM adds a pair of L-point DHT modules inside the transmitter for effective transmission and receiver as a result of the red boxes show for reception which is considered as effective receiption. At transmitter, the knowledge sequences unit of measurement sent to the important constellation plotter which are mostly used for the complexity in presentation is more, the [PAM mapper] when serial-to-parallel converter we used.
Then the generated M-PAM signals square are used to measure sent to the L-point DHT to comprehend the DHT-spread operation performed on input signal. The output of L-point DHT can be given as shown below,

$$X_m = \frac{1}{\sqrt{L}} \sum_{l=0}^{L-1} X_l \, cas\left(\frac{2\pi lm}{L}\right) \quad (2)$$

Where, m is from 0 to $L-1$. X_m is given at odd positions of N-point DHT operation (i.e., N ¼ 2L)

$$Y=[0, X_0, 0, X_1, \ldots, X_{L-1}] \quad (3)$$

After N-point DHT algorithm, the generated OFDM sequences, Y can be given as,

$$Y_i = \frac{1}{\sqrt{2L}} \sum_{h=0}^{2L-1} y_h cas\left(\frac{2\pi hi}{2L}\right) = \frac{1}{\sqrt{2L}} \sum_{j=0}^{L-1} y_{2j+1} \, cas\left(\frac{2\pi(2j+1)i}{2L}\right) \quad (4)$$

Where, i is from 0 to -1 .
As shown in (3), $y_{2j+1} = X_j$

$$Y_i = \frac{1}{\sqrt{2L}} \sum_{j=0}^{L-1} X_j \, cas\left(\frac{2\pi(2j+1)i}{2L}\right)$$
$$= \frac{1}{\sqrt{2L}} \sum_{j=0}^{L-1} \frac{1}{\sqrt{L}} \sum_{l=0}^{L-1} X_l cas\left(\frac{2\pi lj}{L}\right) * cas\left(\frac{2\pi(2j+1)i}{2L}\right)$$
$$= \frac{1}{\sqrt{2L}} \sum_{j=0}^{L-1} \sum_{l=0}^{L-1} X_l [cos\left(\frac{2\pi(i-l)j-\pi i}{L}\right) + \sin\left(\frac{2\pi(i+l)j+\pi i}{L}\right) \quad (5)$$

Therefore, we have to calculate output of N-point DHT Y

$$Y_i = \begin{cases} \frac{1}{\sqrt{2}}[X_i \cos\left(\frac{\pi i}{L}\right) + X_{L-i} \sin\left(\frac{\pi i}{L}\right)] & 0 \le i \le L-1 \\ \frac{1}{\sqrt{2}}\left[X_{i-L} \cos\left(\frac{\pi i}{L}\right) + X_{2L-i} \sin\left(\frac{\pi i}{L}\right)\right], & L \le i \le 2L-1 \end{cases} \quad (6)$$

Y is having anti-symmetrical property. The negative samples of Y should be forced to zero so as to eliminate negative signal. The DHT-S-ACO-OFDM, C, can be obtained from Y by clipping method by thresholding,

$$C_i = \begin{cases} Y_i, & Y_i > 0 \\ 0, & Y_i \le 0 \end{cases} \quad (7)$$

After addition of cyclic prefix (CP) which is nothing but reference bits, digital-to-analog conversion (DAC) and low-pass filter (LPF) modules are used for transmission, the transmitted signal is generated. At receiver, the exact opposite operations are applied as those applied at transmitter side to recover the data sequences, together with analog-to-digital conversion (ADC), applying removal of CP, N-point DHT, channel estimation, as well as L-point DHT and PAM de-mapper.

SUI modeling (As extension)

SUI is nothing but Stanford University Interium .We developed SUI modeling to proposed work to get better results compared with previous state of results.SUI modeling is done with the help of basic parameters of transmission such as antenna correlation, antenna diversity, antenna gain, etc.
There are in all six modeling parameters which are considered different condition of mathematical modules. Among those six mathematical modeling we used SUI-3 model for analysis. We used MATLAB coding for simulation and which are optimal parameters values that we used to get the better enhanced results.

Scenario used for development of SUI Channel Models

Different parameters are used which can be practically observed and calculated the optimal values of them.

Cell size	7 km
BTS Antenna Height	30 m
Receive Antenna Height	6 m
BTS Antenna beam Width	120°
Receive Antenna Beam Width	Omni directional (360°) and 30°.
Vertical Polarization Only	
90% cell coverage with 99.9% reliability at each location covered.	

5. RESULTS

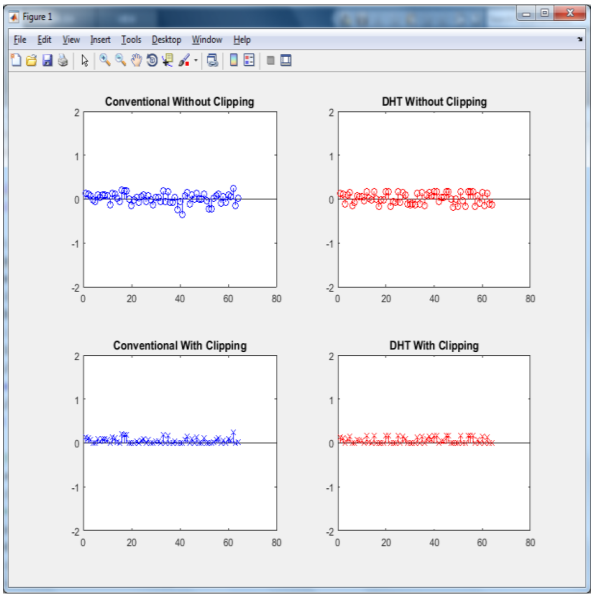

Fig.1 performance of a) conventional without clipping b)DHT without clipping c) conventional with clipping d)DHT with clipping

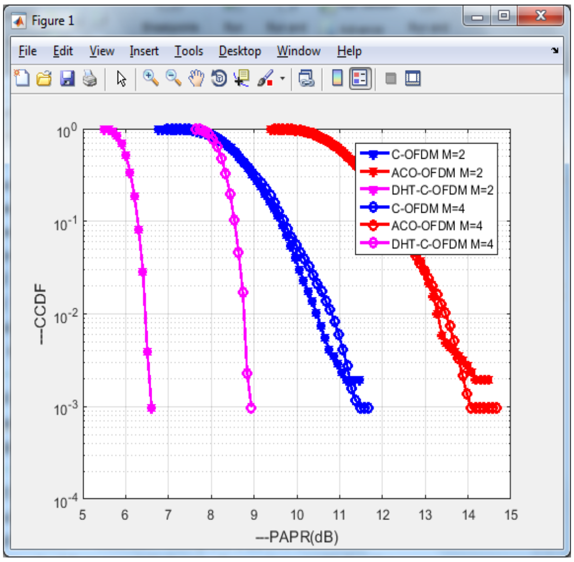

Fig.2 CCDF performance of the conventional, ACO and DHT-S-ACO-OFDM is shown for modulation index M=2,4

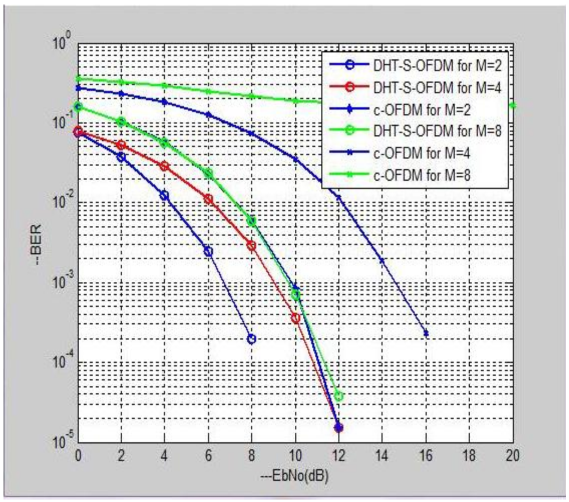

Fig.3 BER performance of the conventional, ACO and DHT-S-ACO-OFDM is shown for modulation index M=2,4.

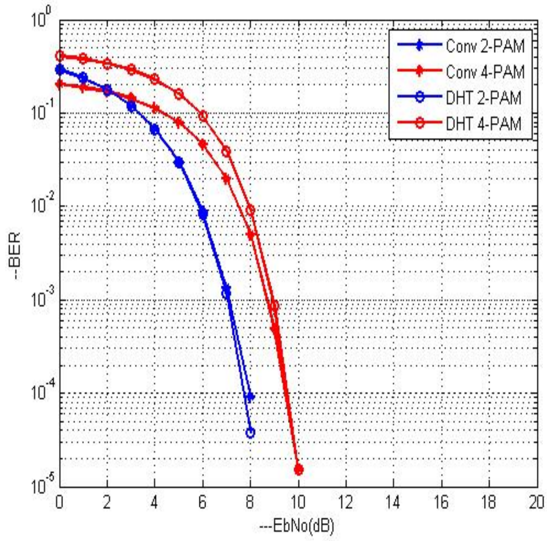

Fig.4 BER performance of proposed work

6. CONCLUSION

We implemented a novel algorithm for PAPR reduction with the help of SUI modeling based on ACO-OFDM. In this we studied about optical wireless communication in which we know the positive peak may contain almost all data. So we will try to clip unwanted data which is analyzed by IM/DD detection for its lowest PAPR. At the CCDF $=10^{-3}$, we calculated the PAPR values which are 9.7 dB and another 6.2 dB less than that of conventional algorithm having the modulations 2-PAM and 4-

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

PAM respectively. By execution of program in MATLAB we also proved that the results obtained by application of SUI channel for ACO-OFDM are better compared to existing state-of-art techniques.

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