IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 Journal Volume 10, Iss 10, 2021

STRATEGIES FOR PAPR REDUCTION IN WIRELESS COMMUNICATION SYSTEMS FOR MASSIVE MIMO

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Abstract*—Multiple input multiple output systems, or MIMOs for short, are wireless communication systems that use a large number of transmitters and receivers to broadcast data at specific intervals. This lets the receiver decode signals from many sources by operating in scattering situations. By spreading and accepting the signals among numerous users, this aids in enhancing the network with increased efficiency. Increasing the number of antennas at the base station is how large-scale MIMO technology is implemented. One of the most challenging limitations that MIMO technology faces today is its high Peak to Average Power Ratio (PAPR). To cover the needed surface area and generate the required power, a High Power Amplifier (HPA) is required. The memory-less non-linear distortion has a significant impact on the communication network's efficiency. The high power amplifier tends to retain the band power at minimum intervals with restricted areas if it is unable to operate at a rectilinear region. To improve performance efficiency, it is crucial to examine and improve the MIMO system's PAPR reduction techniques. Therefore, the PAPR reduction approaches are used to increase the energy efficiency (EE) of the multiple input multiple output (MIMO) system Orthogonal Frequency Division Multiplexing (OFDM).*

Keywords*: base station, antennas, wireless communication system, Peak to Average Power Ratio (PAPR), Multiple Input Multiple Output (MIMO), High Power Amplifier (HPA)*

I.Introduction

The MIMO wireless system is a striking technology in wireless communication system which possess peak to average power ratio (PAPR) used to transmit the signals that tends in the signal distortion [1]. The MIMO system are differentiated into single user (SU and multiple user (MU) systems. It only operates at wireless routers where the data are transferred with the absence of infrastructure. This sends the similar data as signals using multiple antennas in the communication network [2]. This is done at the base station that sends and receive the signals. The transmission of high data rate is achieved through the orthogonal frequency division multiplexing (OFDM) to enhance higher efficiency in the communication system [3]. This is done through the inverse fast Fourier transform (IFFT) system. This helps to make the communicating system more efficient and avoid the interruptions in the system [4]. The high PAPR is a major disadvantage in the MIMO wireless communication system.

The MIMO wireless system are one of the important tool for technological development for 5G communication system [5]. This leads to higher efficiency with speed rate. This

ISSN PRINT 2319 1775 Online 2320 7876
Journal Volume 10, Iss 10, 2021

helps to develop the communication network schemes and to enhance the data rate [6].

The massive MIMO system are also referred as the large scale MIMO system. This helps to meet the demand in the wireless communication network [7]. The massive MIMO system are referred as the several number of antennas that are used to transmit the data in the communication network. This tends to obtain various rapid changes in the networking system for data transmission [8]. The reduction of PAPR is done through the multiple carrier frequency range. The reduction and degradation of the disturbances are reduced due to the development of numerous path in the network [9]. The functioning of system at low power reduces the overall efficiency of the wireless communication system. The MIMO system have an enough strength to reduce the peak to average power ratio in the transmission and receiving of data.

II.PROPOSED SYSTEM

In the wireless communication system, the PAPR is an important issue to extract the overall efficiency and performance of the system. Increase in the PAPR schemes leads to rise in the high power value. The implementation of high power amplifier is a major challenge when the PAPR reduction techniques are much higher. The PAPR reduction technique is obtained through the peak amplitude divide by the average value of the waveform. The optimized data rate transmission in the MIMO system is a complicated process in the implementation because it needs higher computational performance. Thus the PAPR reduction technique is obtained to reduce the noise and fluctuations in the communication network. This includes three stages such as initialization of data, pre-processing with data acquisition and equalization process. This leads to reduce the overall performance loss in the network. This is accompanied with synchronization techniques [10]. Thus by reducing the error rate and PAPR reduction, the network performance is obtained with higher efficiency is accomplished.

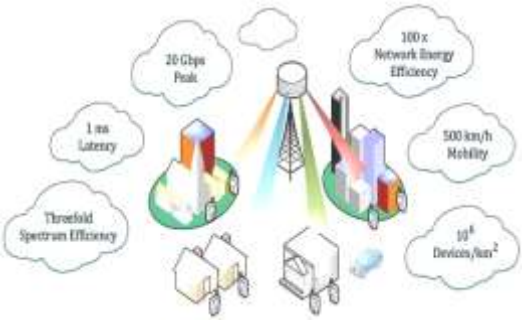

Fig 1: Massive MIMO techniques

The figure 1 represents the massive MIMO techniques. This shows the threshold spectrum efficiency and network energy efficiency. This includes multiple antennas at the base station to transmit and receive signals [11]. They are interconnected with each other to avoid the occurrence of errors and reduction in speed rate. To avoid fading in the communication system, creating numerous version of similar signal gives higher ability of data to be transmitted at a particular period of time [12].

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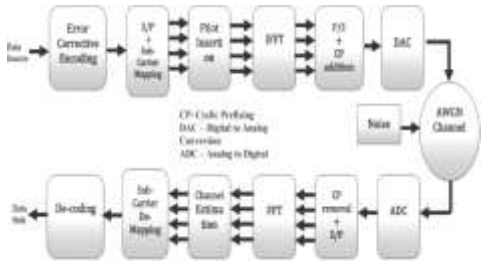

Fig 2: Stages in PAPR reduction schemes

The figure 2 demonstrates the stages in PAPR reduction schemes. The process of reduction in the complexity of the computational performance is achieved to obtain the higher rate of data transmission [133]. The PAPR reduction schemes are done with implementing several physical parameters. To implement higher transmission quality in the wireless technology, the recommended algorithm are done to higher convergence. The loss of data rate in transmission and error in the bit rate are caused due to the absence of the PAR reduction techniques in the wireless communication system [14].

A digital analog converter (DAC) is used to avoid signal distortion and radiation. To avoid the signal distortion and radiation factor, it must operate at a very wide surface areas. This can be classified as sub block strategy and entire block strategy [15]. The non-availability of PAPR techniques causes the communication network to rise in the transmission power and complexity in the overall computational performance [16].

III.METHODOLOGY

In the multiple input multiple output system, numerous numbers of subcarriers are needed to transmit the data which includes the high peak to average power ratio. This can be eliminated by using the partial transmit sequence (PTS) method.

It involves the process of error coding and decoding process with mapping process and to avoid the occurrence of noise in the wireless network [17]. The reduction of PAPR techniques are done with various techniques such as the selective ,mapping techniques, clipping process with filtering techniques and tone reservation process. Thus the partial transmit sequences are adopted in the PAPR reduction techniques [18]. This is based on the particle swarm optimization techniques. The PAPR reduction schemes are much important in the wireless communication system to avoid the presence of signal clipping at the output. It is also accompanied with the manipulation of the signal that are done before transmission [19].

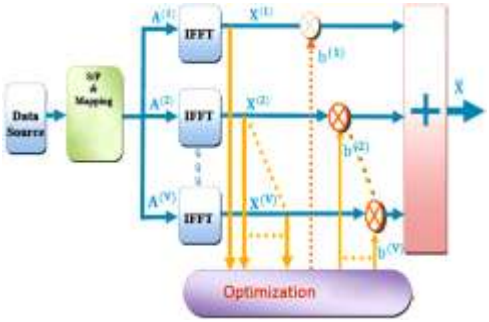

Fig 3: PTS block diagram

The figure 3 demonstrates the PTS block diagram. This is done through the particle swarm optimization techniques. The particle swarm optimization id referred as a population based algorithm which includes the accumulation of particles to move in stages at the particular location [20]. At each

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stages, the algorithm helps in the evaluation of the objective function. [21].

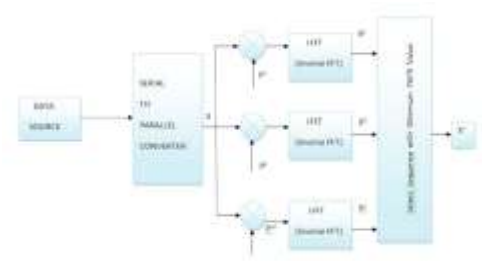

Fig 4: SLM block diagram

The figure 4 represents the SLM block diagram. This is used in moderate sub carriers and done with reduced computation complexity in the system. This provides substantial results and needs appropriate coding to protect the data in the system [22]. Thus the reduced number of PAPR is obtained for transmission. Thus the overall reduction is done through the particle swarm optimization techniques.

Fig 5: Flowchart

The figure 5 represents the flowchart depicting the particle swarm optimization techniques. This includes initialization of data and analyzing the fitness function.

Then obtaining the global optimum value [23]. This is forwarded through the position and rate updating process. Finally the optimum solution is obtained. This is an artificial intelligence techniques that involves the process of obtaining the appropriate solutions for a difficult problems. This also involves maximization and minimization process in analysis of desired output solution in the system

IV.SOFTWARE IMPLEMENTATION AND RESULTS

The improvement and reduction of PAPR schemes in multiple input multiple output system is done in matlab Simulink.

Fig 6: PAPR in matlab

The figure 6 represenst the PAPR reduction technique demonstration in matlab.

Fig 7: Optimization algorithm

The figure 7 represents the algorithm for particle swarm optimization techniques. Optimization is a process of obtaining a desired solution through the obatined data with performing numerous iterations [24].

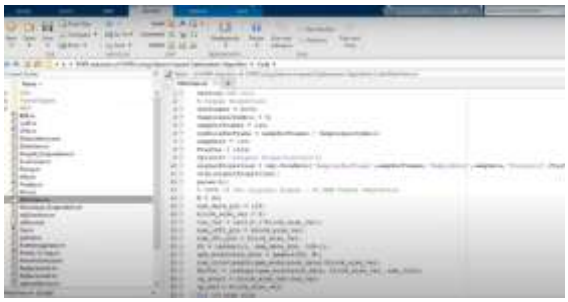

Fig 8: Data pre-processing

The figure 8 represents the data pre-processing and data acquisition techniques. The data preprocesing an important techniques in the reduction process. The data preprocesing helps in obtaining the data without any external disturbances [25].

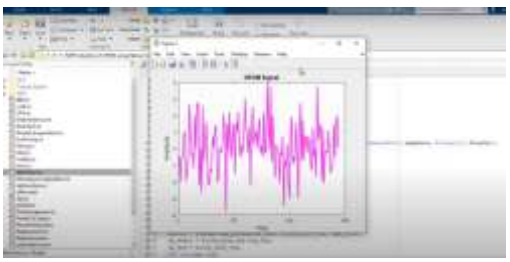

Fig 9: OFDM signal

The figure 9 demonstrates the OFDM signal generation. This is used to encoding the digital data in a multiple carrier frequency. This orthogonal frequency division multiplexing is a form of digital transmission.

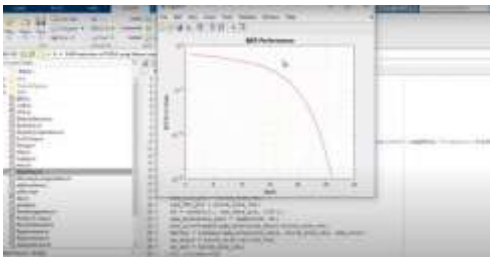

Fig 10 : BER performance

The figure 10 shows the BER performance in the network. The BER performance is defined as the number of bit errors occurred per unit time interval. It is represented in percentage.

V.CONCLUSION

The major objective of the proposed system is to enhance and improve peak to average power ratio (PAPR) reduction tactics in a MIMO wireless system. Particle swarm optimization techniques that consider the power spectrum, frequency spectrum, and BER performance of the network are used to achieve this. Therefore, system efficiency increases and base station data transmission and reception function accurately when PAPR is reduced. As a result, the recommended strategy has a rapid convergence rate and minimal computing overhead.

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