

SC-FDMA with Adaptive Modulation using PN-Sequence and STBC Code

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Abstract— Wireless communication is known as the future trends that are used to communicate between transmitter and receiver. Modulation has been done after generation of the signal in each multiple sub carriers to send it over the channel. OFDM, SCFDMA and other modulation schemes are used and reviewed. Earlier OFDM method was used but it has various disadvantages like it is sensitive to Doppler shift and frequency synchronization problems. It has high peak to average power ratio (PARP), requiring linear transmitter circuitry, which suffers from poor power efficiency. In OFDM method there is loss of efficiency caused by cyclic/guard interval. To overcome these limitations, it was advised to use various coding algorithms like STBC codes which improves efficiency or other multiple access technique like SC-FDMA method. In the proposed system modulation of the signal is performed, addition of Cyclic prefix has been done to obtain high performance data transform and use bandwidth efficiently. Proposed method evaluates STBC code to send single data to multiple routes for the quality enhancement of the signal. Transmission has been done between the receiver and the transmitter where each side involves separately performing their operations. As in the existing system FFT block was not included due to which signal has been distort whereas in the proposed system this DFT block is added before the IDFT block that will help to retain the signal quality. Comparison has been performed through taking signal and performance is evaluated in this thesis to check the efficiency of individual approach.

Key words: OFDM, SCFDMA, PAPR Value, BER Analysis, Fourier Transform, CP (Cyclic Prefix), LTE Uplink Transmission

I. INTRODUCTION

OFDM has been used for multiple transmission of the subcarriers on the channel but due to its demerits of PAPR, BER values different techniques are proposed to avoid these issue. SCFDMA is a technique used to vanish these problems in which single carrier are used for the transmission purposes. Due to the another block of DFT has proposed that causes the low PAPR value where first signal is modeled, Cyclic prefix is added to the signal and then STBC code is applied to the signal and send to the receiving side. On the other hand, receiver removes Cyclic prefix and added code and obtained original signal.

II. PROBLEM STATEMENT

Orthogonal frequency-division multiplexing (OFDM) is a method of encoding digital data on multiple carrier frequencies. OFDM has developed into a popular scheme for wideband digital communication, used in applications such as digital television and audio broadcasting, DSL Internet access, wireless networks, power line networks, and 4G mobile communications. Since, OFDM has various

advantages like efficient implementation using fast Fourier transform, high spectral efficiency, low sensitivity to time synchronization errors and it is robust against inter symbol interference and fading caused by multipath propagation. But there are many disadvantages of the OFDM method. Because of these disadvantages the OFDM method cannot be used by us. OFDM requires very accurate frequency synchronization between the receiver and the transmitter; with frequency deviation the sub-carriers will no longer be orthogonal, causing inter-carrier interference (ICI). The problems that are faced when using OFDM method are that this method is sensitive to Doppler shift. This method is also sensitive to frequency synchronization problems. It has high peak to average power ratio (PAPR), requiring linear transmitter circuitry, which suffers from poor power efficiency. OFDM method also suffers loss of efficiency caused by cyclic prefix/guard interval. So, we need to find out the method which overcomes the limitations of the OFDM method and is more efficient then this method. The STBC codes are used with OFDM which work with MIMO (multi input multi output).

III. PROPOSED WORK

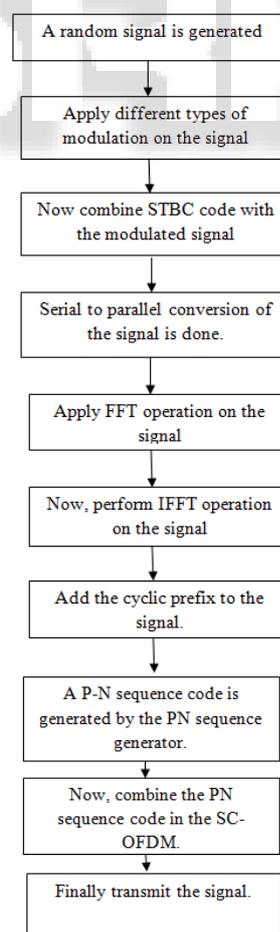


Fig. 1: Proposed Work

Earlier OFDM method was used but it has various disadvantages like it is sensitive to Doppler shift and frequency synchronization problems. It has high peak to average power ratio (PAPR), requiring linear transmitter circuitry, which suffers from poor power efficiency. In OFDM method there is loss of efficiency caused by cyclic/guard interval. To overcome these limitations, it was advised to use various coding algorithms like STBC codes which improves efficiency or other multiple access technique like SC-FDMA method. SCFDMA is itself a approach which is better than the OFDM system, but it is defined that if PN sequence code are attached with the OFDM system the modified part gives much better results than the traditional OFDM so this can also be tried with the SCFDMA system, so that BER can be modified a new thing which can also be applied to the proposed work is that equalizers which are used for equalization of the signal and BER will be refined up to an extent. This modification is applied to the traditional OFDM system that is the final system which will be proposed will have these three things that the OFDM will change to SCFDMA then the PN sequence code will be introduced to it along with the equalizers.

- 1) Initially a random signal is generated carrying the information, which is to be transmitted for communication between the transmitter and the receiver.
- 2) On that transmitted signal different types of modulation techniques are applied and the technique which is best among them is chosen for the modulation of signal.
- 3) After the modulation, STBC code is combined with the modulated signal which is to be transmitted by the transmitter.
- 4) Now, serial to parallel conversion of the signal is done, so that the multiple data is transmitted at a time and also the speed is more.
- 5) After the serial to parallel conversion of the signal is done FFT operation is applied on that signal.
- 6) After applying FFT operation on the signal, next step is to apply IFFT operation on the received signal.
- 7) Now, cyclic prefix is added to the received IFFT Signal, as cyclic prefix is often used in conjunction with modulation in order to retain sinusoids' properties in multipath channels.
- 8) After adding the cyclic prefix, a PN –sequence code is generated, by a PN-sequence code generator.
- 9) After this PN-sequence codes generated by the PN sequence generator is combined in the SC-OFDMA.
- 10) Finally this signal is transmitted from the transmitter.

A. Receiver Side

- 1) Remove Cyclic Prefix from the received signal
- 2) After removing cyclic prefix covert Serial to parallel and then perform FFT and inverse of FFT
- 3) Now Perform signal equalization on the demodulation is then applied. That is demodulating the generated signal. After the signal has been applied all the conversions and it has been modulated, after demodulation perform signal equalization.
- 4) Now calculate the error in the signal.
- 5) Experimental results

In this section of Results and discussion we have discussed about the results that were obtained by applying proposed method. In the propose work new method of reducing PAPR methods are proposed. OFDM has been replaced by the SCFDMA because of the quality of the signal received by the receiver is better and efficient. Communication resources are shared due to which proposed technique is helpful in reducing cost as well.

The very first step involves in the proposed approach is to take information bits as a signal on which further manipulations are performed and results will show the performance of the approach. This signal will send to the receiver side.

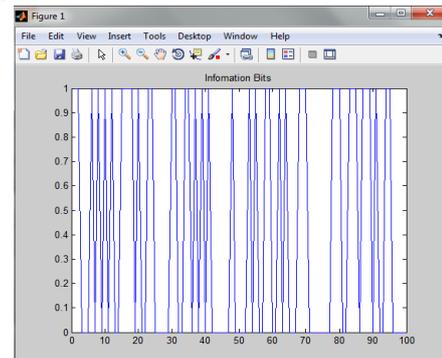


Fig. 2: Signal has been taken for evaluation

After generating the signal, signal will be transmitted to the other end i.e. receiving end. On the other hand receiver will receive the signal. Thus following graph shows the actual signal which forwards on the channel.

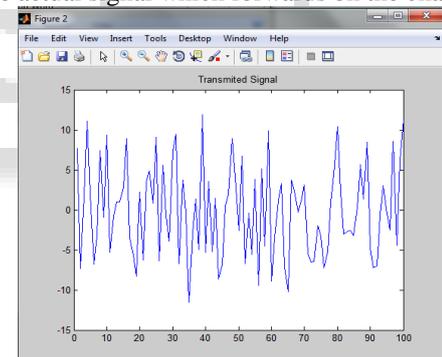


Fig. 3: shows transmitted signal which has been sent by the sender to the receiver. According to the sender actual signal is like this but when it actually transmitted on the signal it may corrupt or destroy.

Step 3 involves the signal that is received from the channel to the receiver send by the transmitter. Thus following graph shows the signal received by the other end in communication.

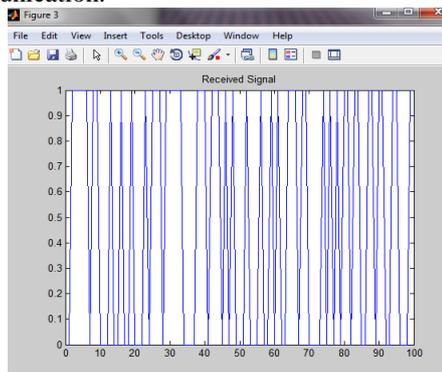


Fig. 4: Shows received signal by the receiver.

After receiving the signal by the other end now its time to evaluate BER of proposed technique through BPSK (Binary Phase Shift Keying modulation) scheme that will able to show the performance of the technique as well as reduction in error rate.

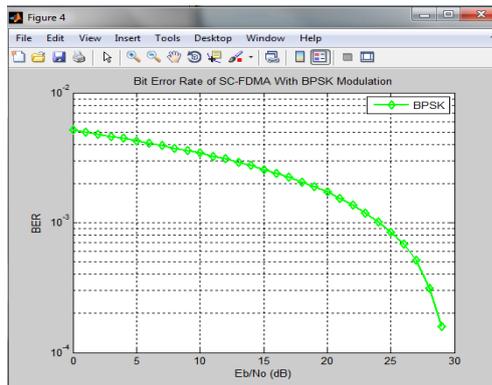


Fig. 5: Graph shows the result of SCFDMA through BPSK modulation scheme over BER

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