DCT LAB PROJECT



**DESIGN AND IMPLEMENTATION OF OFDM TRANSCEIVER SYSTEM**

SUBMITTED BY

SUDIP NAYAK

B220061

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ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING

The Orthogonal Frequency Division Multiplexing (OFDM) is an important aspect of a multicarrier digital data transmission system where a single data stream is transmitted into a several lower rates subcarrier signals. This kind of new standard of transmission of data is the first one to perform with OFDM in a data packet-based communication systems. In a wireless communication networks, the abstraction of parallel transmission of data symbols is implemented to attain high throughput and effective transmission quality. The OFDM is a method to deal with the parallel transmission. In this thesis, there are five different types of techniques introduced to strengthen communication quality and capacity.

The First technique proposed is Power Line Communication (PLC) with Wavelet OFDM. This approach excludes the use of Cyclic Prefix and with this also enhances the performance of the PLC transmission. The proposed PLC model is described for rapid and effective data transmission system over the power line communication channels.

Second proposed technique is clipping of Sub Carrier signals and peak windowing of carrier signals. These techniques were used for minimizing of non-linear distortion caused on OFDM signal. As a result of these techniques, some of the data bits will become out of band radiation. This unwanted effect of out of band radiation can be diverted by operating a linear peak cancellation of subcarrier signals technique, wherein a time shifted base signal and scaled reference function signal is detract from the signal which is to be transmitted. So the detracted reference function signal diminishes the peak power of at least one signal constellation.

In third proposed technique is the issue of decreasing the effects of phase noise which take place in the OFDM system, when the OFDM system is operated with frequency selective fading channel is forwarded. The proposed technique for combined estimation of channel and Common Phase Error (CPE) is done first and clear out of Inter Carrier Interference (ICI) is done in the second step.

In fourth technique, Turbo coding for encoding process and one dimensional (1D) HAAR Discrete Wavelet Transform (HAAR DWT) was used to Multiple Input Multiple Output OFDM system. This DWT based MIMO OFDM is much suitable for mitigating interferences being Inter Carrier Interference (ICI) which happens with Carrier signals and Inter Symbol Interference (ISI) which take place with Data symbols.

In fifth proposed technique is Clipping based Selective Mapping (SLM) which separates data symbols with PAPR within the threshold value and Partial Transmit Sequence (Clipping SLM PTS) technique is introduced to reduce PAPR in OFDM system.

Multi-carrier or orthogonal frequency division multiplexing (OFDM) has become the chosen modulation technique for wireless communications because it provides a high data rate wireless transmission.

When modulation of any form - voice, data, etc. is applied to a carrier, then sidebands spread out on either side. It is necessary for a receiver to be able to receive the whole signal to be able to successfully demodulate the data. As a result, when signals are transmitted close to one another they must be spaced so that the receiver can separate them using a filter and there must be a guard band between them. This is not the case with OFDM. Although the sidebands from each carrier overlap, they can still be received without the interference that might be expected because they are orthogonal to each another. This is achieved by having the carrier spacing equal to the reciprocal of the symbol period.

To see how OFDM works, it is necessary to look at the receiver. This acts as a bank of demodulators, translating each carrier down to DC. The resulting signal is integrated over the symbol period to regenerate the data from that carrier. The same demodulator also demodulates the other carriers. As the carrier spacing is equal to the reciprocal of the symbol period means that they will have a whole number of cycles in the symbol period and their contribution will sum to zero - in other words, there is no interference contribution.

One requirement of the OFDM transmitting and receiving systems is that they must be linear. Any non-linearity will cause interference between the carriers as a result of inter-modulation distortion. This will introduce unwanted signals that would cause interference and impair the orthogonality of the transmission.

In terms of the equipment to be used the high peak-to-average ratio of multi-carrier systems such as OFDM requires the RF final amplifier on the output of the transmitter to be able to handle the peaks whilst the average power is much lower and this leads to inefficiency. In some systems the peaks are limited. Although this introduces distortion that results in a higher level of data errors, the system can rely on error correction to remove them.

Examples of OFDM applications include ETSI BRAN in Europe, IEEE802.11 in the United States, and ARIB MMAC in Japan. Therefore, many research centers in the world have specialized teams working on the optimization of OFDM for countless applications.

This paper is to demonstrate the concept and feasibility of an OFDM system, and investigate how its performance is changed by varying some of its major parameters by using a [MATLAB](https://matlabprojects.org/) program to simulate an OFDM system.

From the process of this development, the mechanism of an OFDM system can be studied [OFDM Channel Estimation using MATLAB](https://matlabprojects.org/ofdm-channel-estimation-using-matlab/); and with a completed MATLAB program, the characteristics of an OFDM system can be explored.

