

# Analysis Of Ofdm System Using Discrete Hartley Transform

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## Abstract

*This paper aims to mitigate the multipath and impulsive noise effect over the powerline communication network using discrete Hartley transforms(DHT) and chaotic interleaving.In order to combat the limitations which are above mentioned,we consider the PLC channel model in the impulsive noise environment.While considering the OFDM, the are two main categories of noise namely, asynchronous impulsive noise and cyclo stationary noise.Our major concern regarding this paper is about DHT . The present paper deals with the method developed for OFDM modulation–demodulation of signal using the FHT algorithm that makes the computational complexity of OFDM implementation to be reduced several fold. In this case, the resultant permutation of input samples makes it possible to usage of the signal waveform at the output of OFDM modulator, which is similar to the waveform obtained in the classicalOFDM scheme using FFT. The proposed implementation makes it possible to clear the use of QAMmodulator and demodulator enabling us to obtain much simpler processing algorithms and the technicaltools for the realization of these algorithms aimed at OFDM execution.*

**Keywords:**Powerlinecommunication,OFDM, Discrete Hartley Transform(DHT),Chaotic interleave.

## Introduction

Nowadays,OFDM plays a vital role in Powerline communication. Conventional OFDM based PLC used the methodologiesSuchas,FastFourierTransform(FFT),DiscreteWaveletTransform(DWT),WaveletPacketTransform(WPT), proved the higher complexity in terms of both hardware and algorithm. this paper focus on upcoming transform model DHT in Powerline scenario.

The main objective of our research deals with the performance of DHT based on the metrics views. PAPR and BER.

DHT can be defined mathematically by the following equation,

DHT of MXM can be created by,

$$T_{ij}=\cos(2\pi ij/M)+\sin(2\pi ij).$$

Where  $i=0, 1, \dots, M-1$ . And  $j=0, 1, \dots, 1$ .

The M XM DHT precoding matrix T is given as,

$$T= [t_{00} \ t_{01} \dots \ t_{0(M-1)}$$

$$t_{10} \ t_{11} \dots \ t_{1(M-1)}$$

$$t_{(M-1)0} \ t_{(M-1)1} \dots \ t_{(M-1)(M-1)}].$$

The proposed implementations make it possible to design a lower complexity model of OFDM based PLC as it has only real terms

and need not to track the  $i$ th and  $i+1$  the terms.

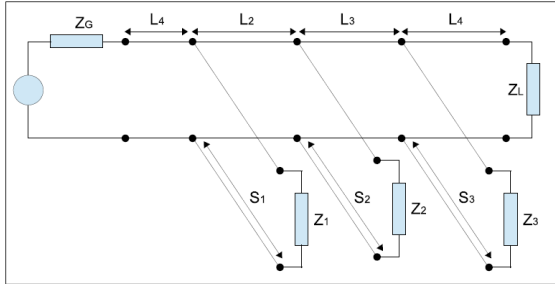
The rest of the paper is organized as follows, In section 2, the main principle behind the OFDM modulation is explained. In section 3 the DHT is detailed.The relationship between dft and dht is given. Section 5 explains the chaotic interleave.

## 2.Main principle of OFDM modulation

The operation of the basic OFDM algorithm involves the transformation of input streams and by serial to parallel conversion which results in the formation of the symbol data stream.

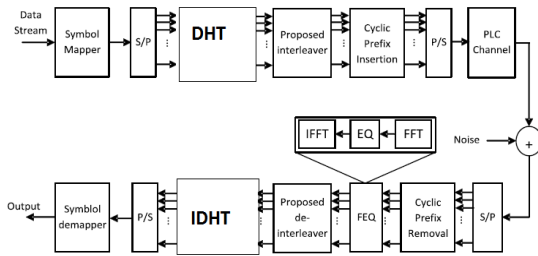
The second stage of transformation is reduced to the formation of the initial sequences  $s(n)$  that will be subjected to the modulation.

From the viewpoint of implementing the most promising technique of forming sequencing  $s(n)$  is the technique using the symmetry of input data length  $2N$  and consequently the complexconjugate spectrum of the specified data.



### 3. Proposed Model

This section explains the proposed method of DHT based PLC and IDHT which is similar to default. Our paper aims to prove the implementation of OFDM by using DHT/IDHT can be substantially simplifies the computation complexity as compared with the algorithm based on FFT.



### Demodulation of OFDM signal by usig FHT

The traditional demodulation scheme which uses the direct FFT implies the need of using complex arithmetic.

Another drawback of FFT and IFFT are not reversible, unlike DHT. In our research the demodulation of OFDM signal is performed by using the correlation QAM demodulator and executing FHT over the demodulated data in phase and quadrature channels while the obtained results are transformed into output stream.

### 4. Relationship between FFT AND DHT

The relationship between FFT and DHT is simple. Let us consider the result of FFT computationa result as  $F(k)$  and that of DHT is  $H(k)$ .  $\text{Re } F(k) = 1/2[H(K) + H(M-K)]$ .

$$\text{IMF}(K) = 1/2[H(K) - H(M-K)]. \quad H(K) = \text{Re}F(K) - \text{IMF}(K).$$

### 5. Chaotic interleaver

Interleaving is required to transmission of data .Due to noise on the PLC channel stronger interleaving mechanism is needed.

The proposed chaotic interleaving mechanism works on the following algorithm:

1. Generation of chaotic sequence using 3D logistic function with the secret key  $s_k$  and intial conditions .
2. Conversion of chaotic sequence into binary sequence .
3. Division of bits in vector  $V_{in}$  into two groups namely B0 and B1.
4. After the first iteration we operate as  $V_{out} = C$ .
5. The above steps is repeated M times in order to have Output distribution and get  $V_{out}$  by concatenating B0 and B1.

### CONCLUSION

This paper explores the design of PLC using DHT which is the upcoming substitution to the conventional transforms. It proves the DHT is simpler than DFT, WPT, DWT and need less hardware that is one core DSP processor and Hartley pipeline can be implemented. The application of DHT ensures a gain in terms of multiplication and addition

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