International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

DOI: 10.48047/IJIEMR/V10/I03/16

Title **OFDM/OQAM PREAMBLE-BASED LMMSE CHANNEL ESTIMATION TECHNIQUE**

Volume 10, Issue 03, Pages: 122-127.

Paper Authors

T.MADHAVA, B.SIVA NAGESWARA RAO

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

OFDM/OQAM PREAMBLE-BASED LMMSE CHANNEL ESTIMATION TECHNIQUE

T.MADHAVA.[1], B.SIVA NAGESWARA RAO[2]
[1] PG Scholar, Dept Of E.C.E, Eswar College Of Engineering, Narasaraopet, Guntur Dt.
[2]Assoc. Professor, Dept Of E.C.E, Eswar College Of Engineering, Narasaraopet, Guntur Dt.

Abstract— In this letter, we developed a novel phase offset (PHO)-based channel estimation method for optical orthogonal frequency division multiplexing (OFDM)/offset quadrature amplitude modulation (OQAM). In this approach, the suppression of intrinsic imaginary interference (IMI) induced by both the linear and nonlinear impairment could be improved by increasing the pseudo pilot power with the using of PHO. As demonstrated in the numerous Montel Carlo simulation results, PHO outperforms the interference approximation methods (IAMs) for both the suppressing IMI and combating the fiber nonlinearity induced interference.

Key words: PHO,OFDM-OQAM,CHANNEL ESTAIMATION, IAM

1.INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) has proven to be very effective when it comes to estimate a multipath propagation channel and to equalize the signal accordingly..In broadband wireless communications, MIMO (Multiple Input Multiple Output) OFDM becomes more efficient to achieve high data rate and better performance. Accurate and efficient channel estimation plays a key role in MIMO-OFDM wireless communications. Channel capacity of MIMO-OFDM system is increased by channel estimation. The increase in the demand for bandwidth and different high performance services opened the door for using multiple antennas at transmitter and receiver. The wireless channel properties are dynamic in nature as it is frequency selective and time-dependent. Multiple Input Multiple Output (MIMO)-OFDM is widely recognized as a key technology for future wireless communications due to its high spectral efficiency and superior robustness to multipath fading channels. In general, there are two groups of channel estimation schemes for MIMO-OFDM system. The first one is nonparametric channel estimation scheme, which adopts orthogonal frequency-domain pilots or orthogonal time-domain training sequences to convert the channel estimation in MIMO systems to that in single antenna systems. However, such scheme suffers from high pilot overhead when the number of transmit antennas increases. The second category is parametric channel estimation scheme, which exploits the sparsity of wireless channels to reduce the pilot overhead. The parametric scheme is more favorable for future wireless systems as it can achieve higher spectral efficiency. However, path delays of sparse channels are assumed to be located at the integer times of the sampling period, which is usually unrealistic in practice. This paper deals with the combination of the OFDM quasi-optimal estimation algorithm in with an IAM estimation process to achieve nearly optimal preamble-based channel estimation in

OFDM/OQAM. Observing that current OFDM/OQAM estimations are sensitive to both noise and intrinsic interference, using a LMMSE algorithm that smooths the estimated channel frequency response by mitigating the noise and interferences appears to be relevant. In addition, to our knowledge, no LMMSE-based estimator has been proposed for OFDM/OQAM in the literature yet.

2.SYSTEM MODEL:

OFDM and OFDM/OQAM systems are both based on the following background: binary data are converted into complex symbols through a mapping based on a symbol constellation.These complex values are organized into vectors containing M subcarriers corresponding to the FFT size. We denote the complex symbol by $C_{m,n}$ with $m \in \{0, 1, \ldots, M-1\}$ the subcarrier index and n the time index corresponding to the current vector. Fig. 1 illustrates in a simple way the organization of the symbols pointed out by a dot in the time-frequency lattice. This general scheme is common to both OFDM and OFDM/OQAM modulations. Vectors of pilot symbols are then multiplexed in the useful data stream. These pilots are samples whose position, gain and phase are known by both the transmitter and the receiver, and are used to estimate the effect of the channel on the signal, in order to invert it. The modulation step is then processed by a simple FFT in OFDM and a synthesis filter bank (SFB) in OFDM/OQAM (see [5] for details concerning the SFB). In the case of an OFDM system, a cyclic prefix (CP) composed of the last samples of the symbol is added at the beginning of the same OFDM symbol. The resulting signal is then transmitted through the channel. On the receiver side, the signal follows a symmetric processing, in addition to the estimation and equalization steps, that are used to estimate the channel perturbation, and to correct the altered signal. In multicarrier systems, after the demodulation process, one can write the following general expression of the received signal R as

$R = GC + W + I$---------1

with G the channel frequency response, C the transmitted signal, W the additive noise and I the intrinsic interference. Note that in OFDM systems, due to the CP and the rectangular pulse shape there is no intrinsic and inter-symbol interference so (1) is simplified to
$R = GC + W$.------------- (2)
In OFDM/OQAM systems, the waveforms are not orthogonal anymore so that the symbols interfere with each other, as shown

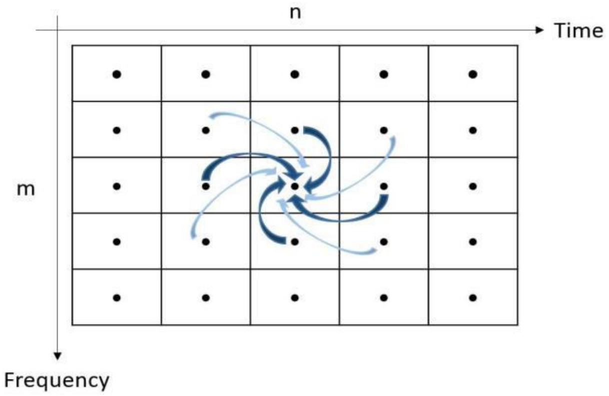

Fig. 1. Time-Frequency lattice showing the symbol positions in OFDM or OFDM/OQAM systems. For the latter modulation scheme, the arrows illustrate, considering the central position, the interference from the neighboring subcarriers.

in Fig. 1. Thus, at the frequency-time position (m, n), the received symbol is:

$$\hat{C}_{m,n} = G_{m,n}C_{m,n} + W_{m,n} + \underbrace{\sum_{m',n' \in \Omega_{m,n}} G_{m',n'}C_{m',n'}\left\langle h_{m,n}, h_{m',n'}\right\rangle}_{jI_{m,n}},$$

where the pulse shapes hm,n belong to a Gabor family (see [11]) and jIm,n is the intrinsic interference at the position (m, n). We will call m,n the set of frequency-time positions (m′, n′) corresponding to the area around (m, n) in which symbols will significantly interfere with the current position. Practically, m,n contains only a few subcarriers and time positions. Note that with common pulse shapes, the interference is in quadrature with the transmitted symbol, as denoted by the j (see [5]). We assume that the modulation and demodulation prototype filters h are the same, and that the transmitter and the receiver are perfectly synchronized. In both OFDM and OFDM/OQAM modulation schemes, the Gm,n coefficients need to be known in order to correct the received symbols. This is the task of the estimation step, that will now be presented.

3.EXISTING SYSTEM

Frequency reuse

A network may be powerful skill that one may re-use radio frequencies so increase the two news furthermore power.

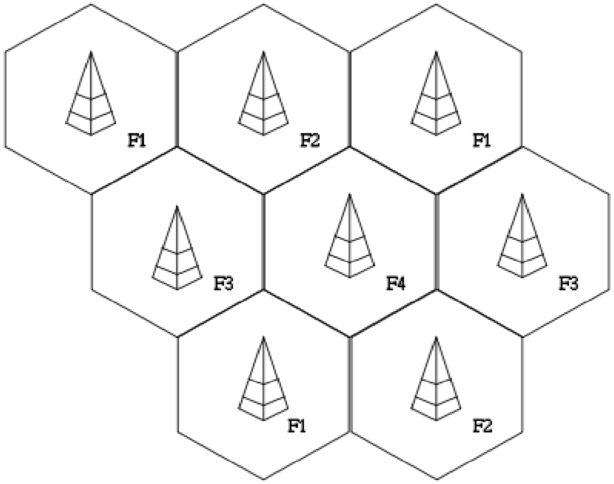

fig.1 Frequency reuse factor or pattern ¼

As represented on top of, adjoining proteins moldiness employ abundant transmitters, there as well will be no poser along with couple fibers enough a ways special in operation on sensational identical oftenest. Sensational elements who settle oftenest utilize will be the overall recycle length along with spectacular reprocess thing.

The utilize wheelbase, vitamin d are often plotted given that spot causative serves as spectacular fertilized ovum semi diameter plus gas will be powerful number consisting of polymers specified by clustering spectacular frequency reprocess issue serves as sensational unhurriedness at and that powerful synoptic audio frequency may be employed flourishing spectacular grillwork. It will be one million/m (or thou according that one may any books) locus 1000 can be the overall number in reference to fibers and one that cannot utilization spectacular selfsame radio frequencies as transmittal. Principles for the reason that the overall rate reprocess agent are going to be one thousand thousand/trio, 000/quaternion, a million/septet, a million/nina from carolina furthermore a million/12 (or trio, quaternion, heptads, inner plus 12 contingent on notation).

CHANNEL ESTIMATION:

Channel estimation is used to obtain the channel state information to know the channel properties using blind channel estimation and pilot-based channel estimation. This information describes how a signal gets propagate from the transmitter to the receiver and represents the combined effect of fading, scattering etc. and power decay with distance. The Channel State Information (CSI) makes it possible to adapt transmissions to current channel conditions, which is crucial for achieving reliable communication. In this paper, only the block pilot based channel estimation technique is investigated. Channel estimation can be performed by either inserting pilot tones into all of the subcarriers of OFDM symbols with a specific period or inserting pilot tones into each OFDM symbol. The block type pilot channel estimation is developed under the assumption of slow fading channel.

4.PROPOSED SYSTEM

CHANNEL ESTIMATION IN OFDM/OQAM AND OFDM SYSTEMS:

Channel estimation may be a crucial part of communication receivers. As a result, numerous estimation techniques are developed for OFDM and a lot of recently for FBMC. Among them, we are going to currently present the 2 ones we are going to concentrate on.

A. Channel estimation in OFDM/OQAM:

Channel estimation in OFDM/OQAM systems has been a tough task because of the lack of CP, and to the necessary interference caused by the non orthogonality of the system. The IAM estimation relies on the subsequent idea: during a scenario while not channel nor noise, it's doable to predict the value of received symbols, if we all know which of them are transmitted. This ideal received is written

$$\breve{C}_{m,n} = C_{m,n} + jU_{m,n}$$

the intrinsic interference assuming an ideal channel (G = 1). In those conditions and under the
hypothesis of a flat channel overΩ , from (3) one can approximate that the received symbol by:

$$\hat{C}_{m,n} \approx G_{m,n}\left(\breve{C}_{m,n}\right) + W_{m,n}$$

In this process, it has become possible to estimate the channel coefficients, under the hypothesis of a locally flat channel as

$$\hat{G}_{m,n} = \frac{\hat{C}_{m,n}}{\breve{C}_{m,n}}$$

This observation is base of the IAM estimation techniques. The IAM processes enable to understand a simple zero forcing equalization, however remain quite sensitive to noise, and they are restricted by the hypothesis of a locally flat channel. The less this hypothesis is verified throughout the transmission, residual interference from neighboring transmitted values will remain same. In such conditions, employing a LMMSE algorithm appears to be extremely interesting option, for it permits to considerably decrease the interferences. But, as aforesaid before, LMMSE needs the covariance of the channel that's a priori unknown at the receiver. Consequently, it's difficult to implement.

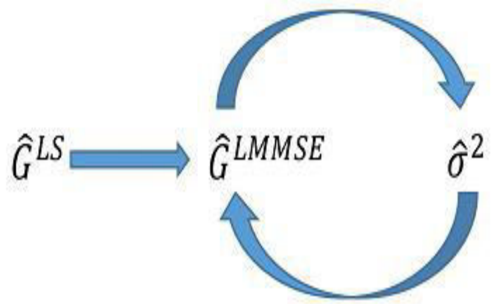

Figure.2: Joint estimation algorithm fundamental principle

In a OFDM context, a joint channel/noise estimation algorithm is for preamble-based estimation in order to overcome this drawback. Hereafter, we present the latter and propose to adapt it to OFDM/OQAM modulation scheme.

B. LMMSE-based estimation algorithm

Classical LMMSE estimation relies on the following expression:

$$\hat{G} = R_G(R_G + \sigma^2 Id)^{-1}\hat{G}^{LS}$$

C. Algorithm to OFDM/OQAM:

To the best of our knowledge, no LMMSE estimation method has been proposed for OFDM/OQAM. In Order to adapt the LMMSE joint algorithm to OFDM/OQAM systems, one needs to determine which parts have to be modified:

The initialization is made by LS estimation.

As this estimation technique that is adapted to OFDM is sensitive to the noise, it cannot be

satisfying in OFDM/OQAM systems due to the interference. Therefore this step must be replaced by an estimation that takes this interference into account, such as IAM as presented just before. The iterative part is purely mathematical and is independent from the nature of the system. It should not be modified in a first approach, except maybe for the initial noise variance estimation, as it is not anymore an LS estimation that is processed.

This estimator can be used for Zero Forcing equalization in OFDM systems, and should be

used to do Zero Forcing in OFDM/OQAM systems.

5.SIMULATION RESULTS:

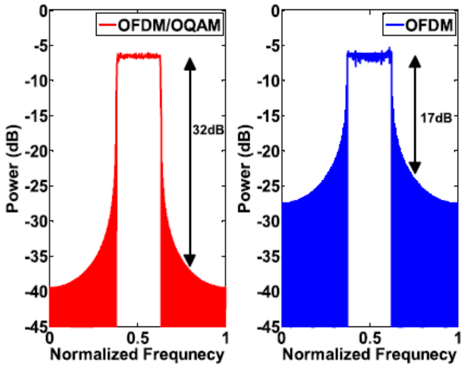

Fig 3: Comparison of the emitted spectrum of optical OFDM/OQAM and optical OFDM at the transmitter side.

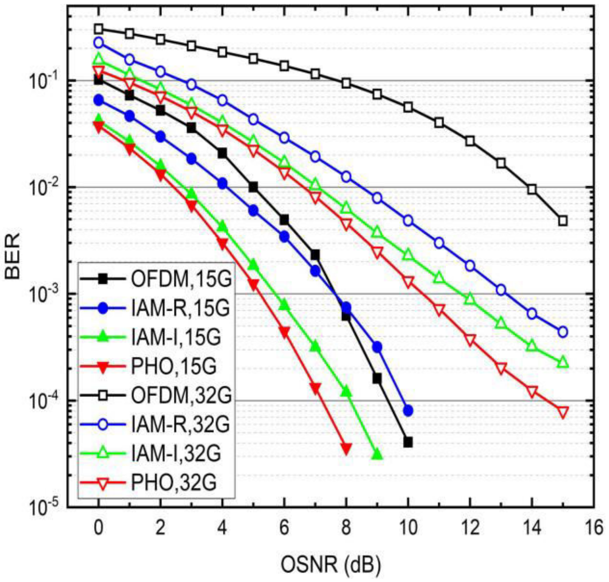

Fig 4: Comparison of the BER performance of optical OFDM/OQAM using PHO,

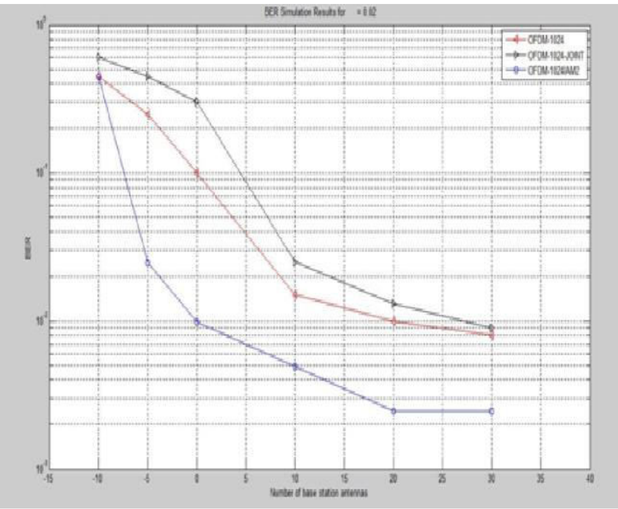

Fig 5: comparision of ber performance analysis

6.CONCLUSION:

Channel estimation attains attention in communication domain due to its ability to give statistics about noise data. Although tremendous progress has been made in literature but still achieving low computational complexity based estimation is a problem. A LMMSE estimation algorithm for OFDM and successfully adapted it to OFDM/OQAM systems, by combining it with an existing preamble-based OFDM/OQAM estimation process. This resulted into the development of a LMMSE preamble-based estimation for OFDM/OQAM without prior knowledge of the channel covariance matrix. To the best of our knowledge, there was no LMMSE estimation available for OFDM/OQAM, making this new algorithm the first of its kind in this modulation scheme.

REFERENCES

[1] R. V. Nee and R. Prasad, "OFDM for Wireless Multimedia Communications," Artech House, 2000.

[2] J. Scott, "The how and why of COFDM," EBU Technical review, Jan 1999.

[3] P. Vaidyanathan, "Multirate digital filters, filter banks, polyphase networks, and applications: a tutorial," Proceedings of the IEEE, vol. 78, no. 1, pp.56–93, Jan 1990.

[4] P. N. Heller, T. Karp, and T. Q. Nguyen, "A General Formulation of Modulated Filter Banks," IEEE Trans. Signal Processing, vol. 47, pp. 986– 1002, 1999.

[5] B. Le Floch, M. Alard, and C. Berrou, "Coded orthogonal frequency division multiplex,"
Proceedings of the IEEE, vol. 83, no. 6, pp. 982– 996, Jun 1995.

[6] M. Biguesh and A. Gershman, "Training-based MIMO channel estimation: A study of estimator tradeoffs and optimal training signals," IEEE Trans. Signal Processing, vol. 54, pp. 884–893, 2006.

[7] O. Edfors, M. Sandell, J.-J. van de Beck, and S.K. Wilson, "OFDM channel estimation by singular value decomposition," IEEE Trans. Communications,vol. 46, pp. 931–939, 1998.

[8] V. Savaux, Y. Louet, M. Djoko-Kouam, and A.Skrzypczak, "Application of a joint and iterative MMSE-based estimation of SNR andfrequencyselective channel for OFDM systems,"
EURASIP Journal on Advances in Signal Processing, vol. 2013, no. 1, p. 11, 2013. [Online]. Available: http://asp.eurasipjournals.com/content/2013/1/128

[9] C. L´el´e, J.-P. Javaudin, R. Legouable, A.Skrzypczak, and P. Siohan, "Channel estimation methods for preamble-based OFDM/OQAM modulations," Euro Wireless '07, Apr 2007.