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Performance Analysis for Frequency Domain Oversampling in OFDM

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Abstract:- In FDO based scheme, by inserting a zero postfix in transmitter data block, and performe Fractionally Spaced Frequency Domain(FSFD) minimum mean sqaure error(MMSE) at received data blocks. Then compare with conventional MMSE receiver using Cyclic Prefix (CP) without FDO. To provide error performance of FSFD-MMSE receiver
Keywords: - Frequency Domain Oversampling (FDO), Minimum Mean Square Error (MMSE), Orthogonal Frequency Domain Multiplexing (OFDM), Two way Relay Channel (TWRC).

I. INTRODUCTION

An effective model to exchange the information between two terminals with the help of relays is two way relay channel model. There are three major models which completes the information exchange according to time slot, i.e., Two stage TWRC, three stage TWRC and four stage TWRC [1].we consider a two stage TWRC since it has high spectral efficiency.[3]

In TWRC include typical relay processing strategies that are amplify and forward[2], de-noise and forward[4],compute and coding[5] and filter and forwarding[].For Frequency Selective Fading Channel Filter and Forward relay strategy is designed, where a filtering operation is performed at relay to maximize the received signal-to-Noise ratio or to minimize the mean square error of receiver at terminals [6].

In addition, other relay processing strategies can also be applied for both flat-fading and frequency-selective fading channels in essence. For the frequency selective channel, single carrier transmission with complex equalizer and multicarrier orthogonal frequency division multiplexing (OFDM) transmission with simple single tap equalizer [7] is considered. The OFDM transmission using a Cyclic Prefix (CP), over single-carrier transmission has an advantage overcome inter-symbol interference and disadvantage of extracting no frequency diversity.

Frequency Domain Oversampling (FDO) is a technique for the frequency-selective channel, which has been used successfully in OFDM system, the multicarrier code-division multiple-address system [8].In FDO based scheme, a zero postfix (ZP) other than CP is inserted as the guard interval at the transmitter, and the fractionally spaced frequency domain (FSFD) minimum mean square error (MMSE) detection employed at the receiver. The major feature of the OFDM is that the FSFD-MMSE receiver can extract the frequency diversity on frequency-selective fading channel.

The main objective of this paper is that to use FDO technique in Two Way Amplify and Forward Relay (TWAR) is the trans receiver design at all Two Way relay Channel (TWRC) nodes to extract the frequency diversity.

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II. FREQUENCY DOMAIN OVERSAMPLING –BASED TWO WAY AMPLIFIED-AND-FORWARD RELAYING

A **two-way radio** is a radio that can both transmit and receive (a transceiver), unlike a broadcast receiver which only receives content. A two-way radio (transceiver) allows the operator to have a conversation with other similar radios operating on the same radio frequency (channel). Two-way radios are available in mobile, stationary base and hand-held portable configurations. Hand-held radios are often called walkie-talkies, handie-talkies, or just hand-helds. Two-way radio systems usually operate in a half-duplex mode; that is, the operator can talk, or he can listen, but not at the same time. A push-to-talk or Press to transmit button activates the transmitter; when it is released the receiver is active. A mobile phone or cellular telephone is an example of a two-way radio that both transmits and receives at the same time (called full-duplex mode). It uses two different radio frequencies (channels) to carry the two directions of the conversation simultaneously. In statistics and signal processing, a Minimum Mean Square Error (MMSE) estimator is an estimation method which minimizes the mean square error (MSE) of the fitted values of a dependent variable, which is a common measure of estimator quality

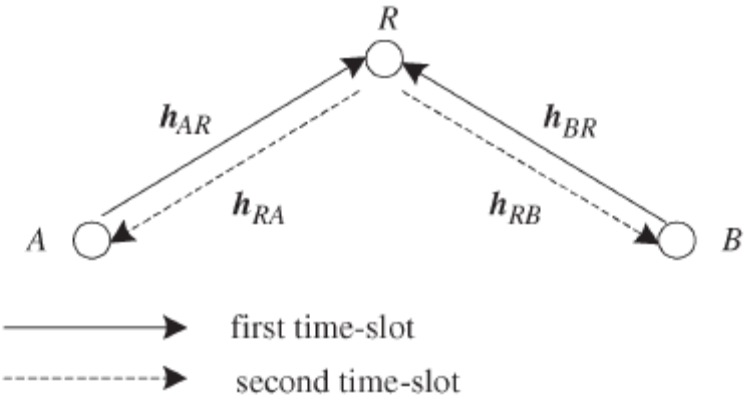

Fig.1. Two-stage TWAR model.

The term MMSE more specifically refers to estimation in a Bayesian setting with quadratic cost function. The basic idea behind the Bayesian approach to estimation stems from practical situations where we often have some prior information about the parameter to be estimated. For instance, we may have prior information about the range that the parameter can assume; or we may have an old estimate of the parameter that we want to modify when a new observation is made available; or the statistics of an actual random signal such as speech. This is in contrast to the non-Bayesian approach like minimum-variance unbiased estimator (MVUE) where absolutely nothing is assumed to be known about the parameter in advance and which does not account for such situations. In the Bayesian approach, such prior information is captured by the prior probability density function of the parameters; and based directly on Bayes theorem, it allows us to make better posterior estimates as more observations become available. Thus unlike non-Bayesian approach where parameters of interest are assumed to be deterministic, but unknown constants, the Bayesian estimator seeks to estimate a parameter that is itself a random variable. Furthermore, Bayesian estimation can also deal with situations where the sequence of observations is not necessarily independent. Thus Bayesian estimation provides yet another alternative to the MVUE. This is useful when the MVUE does not exist or cannot be found.

III. FRACTIONALLY SPACED FREQUENCY DOMAIN-MINIMUM MEAN SQUARE ERROR RECEIVER

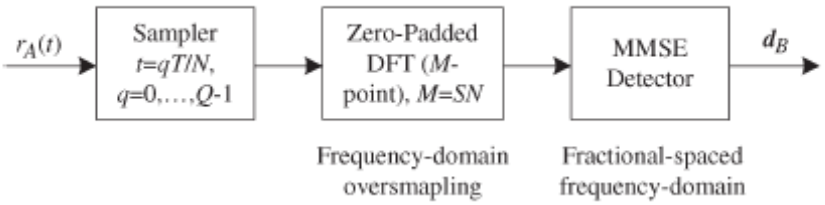

Fig.2. Block diagram of the FSFD-MMSE receiver.

Here, the linear MMSE estimate of the transmitted data symbol vectors **d***A* and **d***B* at terminals *B* and *A*, respectively, is studied. Similarly, only the linear MMSE estimate of **d***B* at terminal *A* is presented. In addition, the result can be extended to terminal *B* directly. It should be noted that the Moore–Penrose pseudo inverse issued because oversampling leads to an over determined system ($M \geq N$) and that the matrix to be inverted is rank deficient.

Due to the matrix inverse involved, the complexity of the FSFD-MMSE hasan order of $O(M3)$. Noting that the complexity of the conventional MMSE receiver has an order of $O(N3)$, the proposed FSFD-MMSE has higher complexity than the conventional MMSE receiver since $M > N$. To avoid the complex matrix inverse computation, a simple method is to approximate matrix E[**y***A***y***HA*] by a diagonal matrix whose diagonal elements are the same as those of E[**y***A***y***HA*].Moreover, for simplicity, the receiver with this approximation is referred to as diagonal FSFD-MMSE receiver.

IV. CONCLUSION

FDO-based transceiver scheme for the TWAR on the frequency-selective fading channel has been proposed in the proposed scheme, the FSFD-MMSE receiver is employed, which can extract frequency diversity from the OFDM signal.

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