| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 8, August 2020||

Algorithms & Simulation on Two Way Relay Semi-blind Estimation using MIMO-OFDM

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ABSTRACT: The channel estimation problem for MIMO-OFDM systems and proposes to pilot-tone based estimation algorithm and computation. Our proposed semi-blind estimator is based on the Gaussian maximum likelihood estimation (GML) criterion which treats that data symbols as Gaussian-distributed nuisance parameters of channel matrix. To assist in the estimation of the individual channels estimation, we adopt a superimposed training strategy at the relay. We have design the pilot vectors of the terminals and the relay to optimized estimated performances .We use simulation result to show that the proposed method provides improvement in channel estimation accuracy over the conventional pilot-based estimation on channel and it approaches the semi-blind Cramer Rao Bound (CRB) as Signal to Noise ratio (SNR) increases & the simulation results shows that the performance of the proposed estimators is relating to the derived Cramer rao lower bound (CRLBs) at moderate to high SNR. It is also shows that the overall BER performance of the AF TWRN is close to a TWRN.

KEYWORDS: Channel estimation, Mean square error, least square, compressed sensing, block error rate.Multiple Input Multiple Outputs (MIMO).

I. INTRODUCTION

In MIMO system, multiple numbers of transmitters at one end and multiple numbers of receivers at the other end are effectively combined to improve the channel capacity of wireless systems. This technology highly improves the spectrum efficiency, reliability of system & coverage Area.

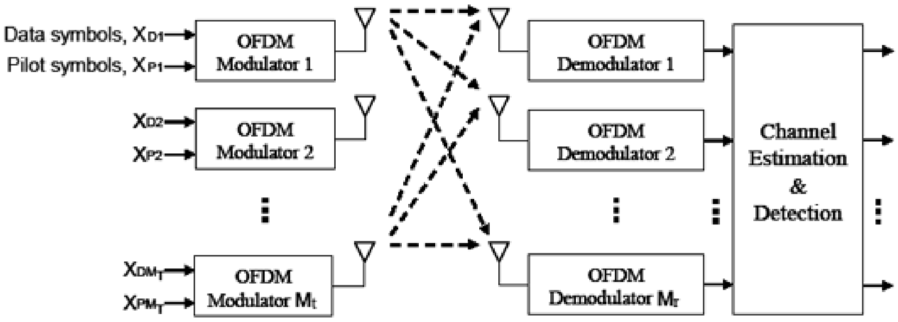

Figure 1: A simple MIMO-OFDM system

Both amplify-and-forward and decode-and-forward protocols have been designed for TWRNs. If comparison to the DF protocol & AF protocol is widely adopted, as it requires minimal processing at the relay node [3] .The two phase communications in AF TWRNs, the two users firstly transmit data to the relay node than relay broadcasts its receive signal to both users in the second in phase1 the two users signals at the relay node under different propagation paths and may not be aligned in time and frequency. The superimposed signal broadcasted from the relay node is affected by multiple impairments examples are channel gains, timing offsets & CFO. The estimation and compensation algorithms have been applied to counter these impaired in unidirectional relaying networks [5], [6] the proposed algorithms can't be applied directly to (Two Way Relay Networks) TWRNs due to differences between the two system models. In TWRNs Fig. 1.

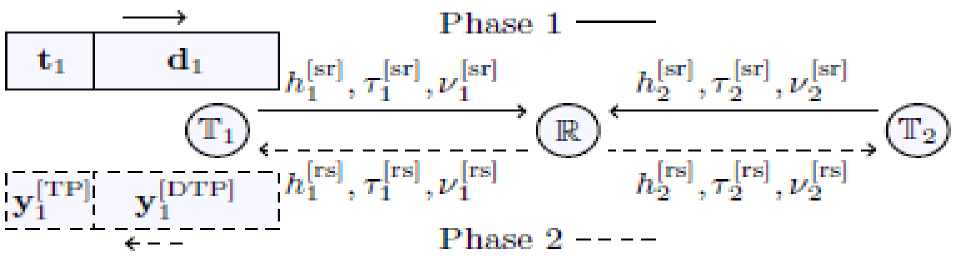

Figure.2: System Model for AF two-way relay network

II. PROBLEM IDENTIFICATION

Two-way relaying networks are designed for bandwidth efficient use of the available spectrum, since it will allow for data exchange between two users with the involvement of an intermediate relay node. Due to superposition of signals on the relay node, the received signal at the user terminals is affected by the multiple parameters like channel gains, timing offsets, and carrier frequency offsets whichhas needed to be estimated and compensating. Our proposed is semi-blind estimator is based on the Gaussian maximum likelihood (GML) criterion which treats that data symbols as Gaussian-distributed nuisance parameters on the channel estimation. To assist in the estimation of the individual channels, we can adopt a superimposed training strategy on the relay. We have designed the pilot vectors of the terminals and the relay to optimization to the estimation performance of channel. Moreover it we compare the semi-blind and pilot-based Cramer-Rao bounds (CRBs) to use as performance benchmarks because CRB gives a lower bound on the achievable estimation error.

III. SYSTEM MODEL & PROPOSED WORK

The channel estimation problem for MIMO-OFDM systems and proposes to pilot-tone based estimation algorithm and computation. A complex equivalent baseband Multiple Input Multiple Output-Orthogonal Frequency Division Multiplexing MIMO-OFDM signal model is presented by matrix represented. To choosing L equally-spaced and equally-powered pilot tones from no. of sub-carriers (N) in one OFDM symbol, a down-sample version of the original signal model has been obtained. Furthermore, this signal model is transformed into a linear form to solvable to LS (least-square) CRB estimation algorithm.

III. FLOW CHART & ALGORITHMS.

Algorithm :

In this algorithm we evaluate overall performance MMSE of LSE MIMO OFDM channel estimation v/s signal to noise ratio(db),delta(delay time) and K(data symbols block)

Step1.Defining sweep parameters like SNR_DBV (vector of SNR value in DB),SNR_DBVL(length of Snr vector)length Nt.Nr, nmontecarlovalue.

Step2.Set value of variable SNR_DBV,SNR_DBVL,Nt,Nr

Step3.Set value of parameter MMSE_CHAN_SIM_random,MSE_CHAN_CRB_random,MSE_CHAN_BER with LSE channel estimation BLIND_CHAN_SIM,BLIND_CHAN_CRB at the values 9,20 for delay time and data symbols block.

Step4. Formulate these values by Monte carlo counter loop for K and δ defining in step1.

Step5.Simulation output graph having comparison between above parameter.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 8, August 2020||

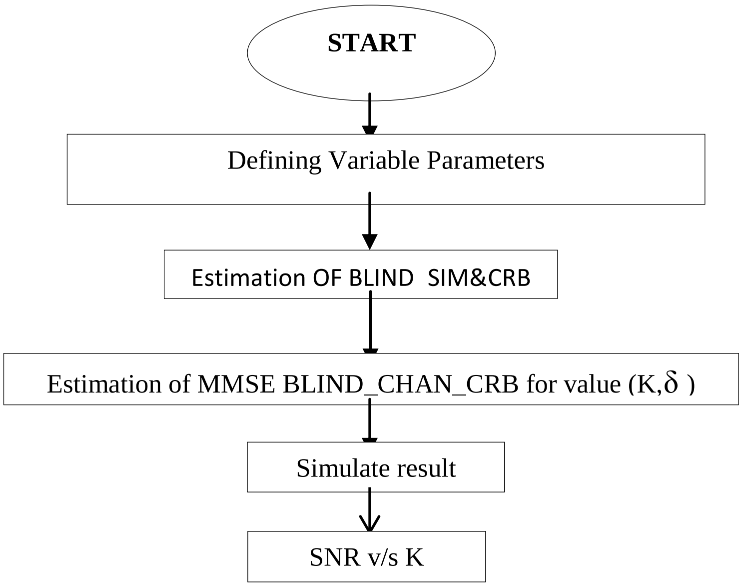

Fig 3: Flow Chart for Algorithm MMSE of LSE MIMO OFDM channel estimation v/s signal to noise ratio(db),delta(delay time) and K(data symbols block)

IV. SIMULATION RESULT

The performance of the semi-blind algorithm closelyapproaches the derived semi-blind CRB as SNR increases. Finally,these performance gains can be achieved at a reasonablecomputational cost, which clearly establishes the merit andpracticality of semi-blind channel estimation for AF TWRNs.In this section, we investigate through simulations the performanceof the proposed semi-blind algorithm and compareit to that of the pilot-based LS estimator.

S.No	Parameters	Value
1	Signal to noise ratio (SNR)	15db
2	No of Transmitters (Nt)	2
3	No of receivers (Nr)	2
4	Data sample blocks (K)	1-50
5	No of bits (Nb)	1-50

Table 1 For simulation Parameters MSE performances of the semi-blind and pilot-based (LS) estimators along with the corresponding semi-blind and pilot-base of Gaussian-distributed and QPSK-distributed data symbols.

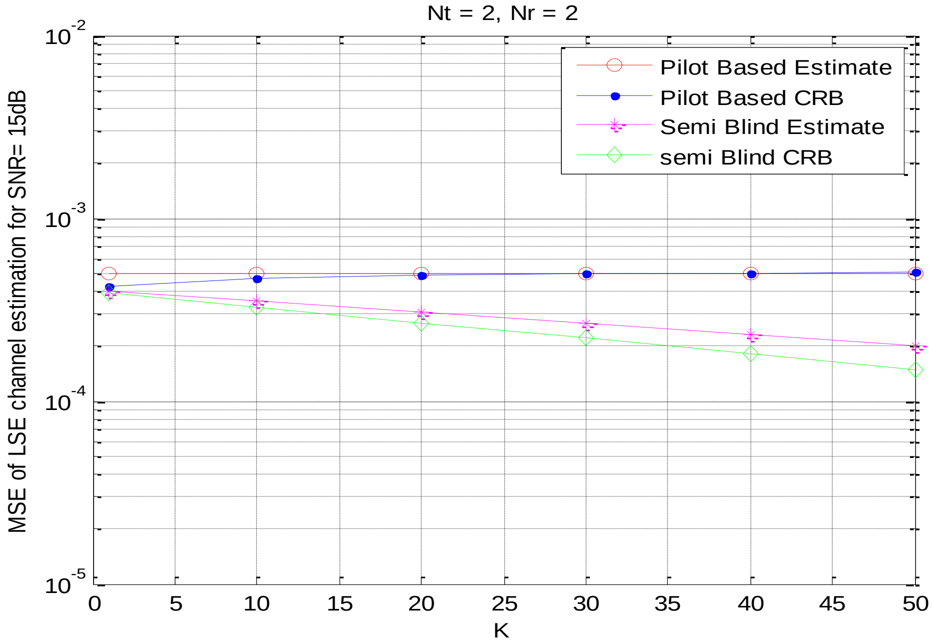

Fig:4 MSE performances of the semi-blind and pilot-based (LS) estimators along with the corresponding semi-blind and pilot-based CRBs plotted versus K for the cases of Gaussian and QPSK-distributed data symbols.

S.No	Parameters	Value
1	Signal to noise ratio (SNR)	15db
2	Signal to noise ratio (dbVL)	3-15db
3	No of Transmitters (Nt)	2
4	No of receivers (Nr)	2
5	Data sample blocks (K)	9
6	No of bits (Nb)	1-50
7	Delay time(δ)	20

Table 2 Forestimation parameters for MSE performance of the LS estimator and the semi-blind estimator versus SNR (L = 10, N = 32) for three scenarios: 1) optimal pilots (κ = 9, δ = 20), 2) suboptimal pilots (κ = 9, δ = 15) and 3) randomly generated pilots.

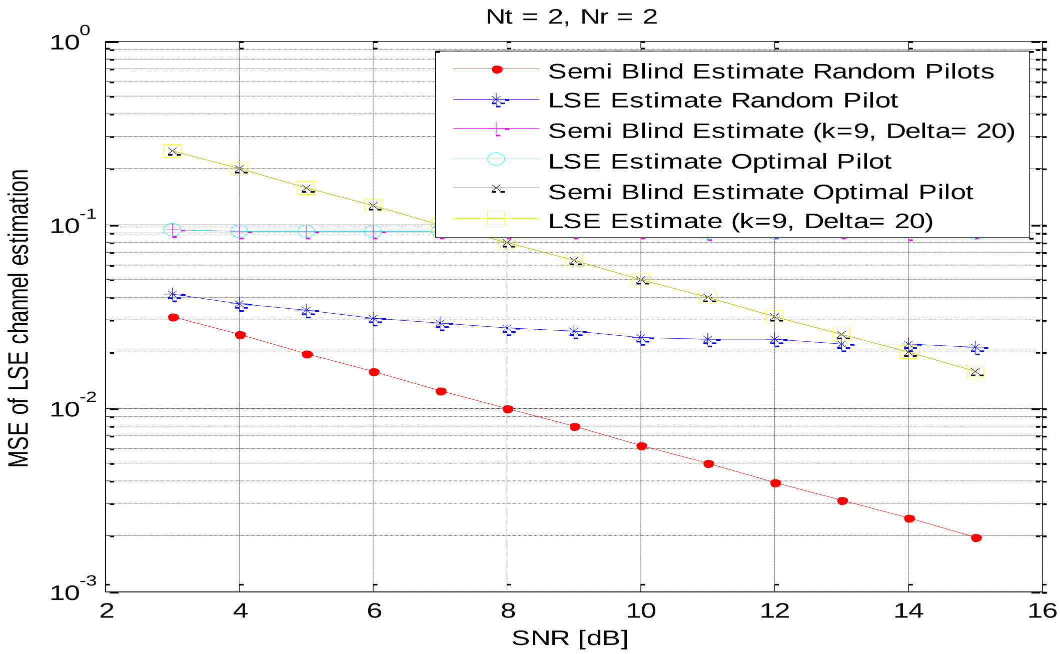

Fig: 5MSE performance of the LS estimator and the semi-blind estimator versus SNR (L = 10, N = 32) for three scenarios: 1) optimal pilots (κ = 9, δ = 20), 2) suboptimal pilots (κ = 9, δ = 15) and 3) randomly generated pilots.

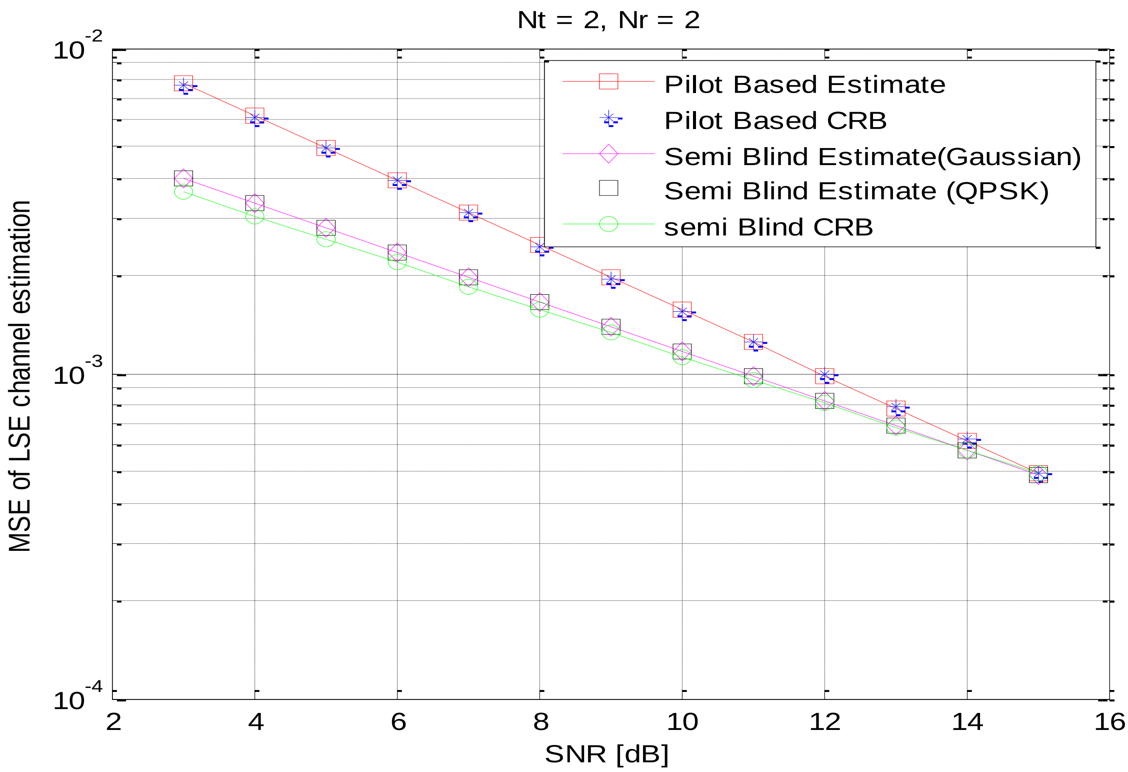

Fig: 6 MSE performances of the semi-blind and pilot-based (LS) estimators along with the corresponding semi-blind and pilot-based CRBs plotted versus SNR for the cases of Gaussian-distributed and QPSK-distributed data symbols.

S.No	Parameters	Value
1	Signal to noise ratio (SNR)	15db
2	No of Transmitters (Nt)	2
3	No of receivers (Nr)	2
4	Data sample blocks (K)	1-50
5	No of bits (Nb)	1-50

Table 3 Estimation of parameters for 3 MSE performances of the semi-blind and pilot-based (LS) estimators along with the corresponding semi-blind and pilot-based CRBs plotted versus SNR for the cases of Gaussian-distributed and QPSK-distributed data symbols.

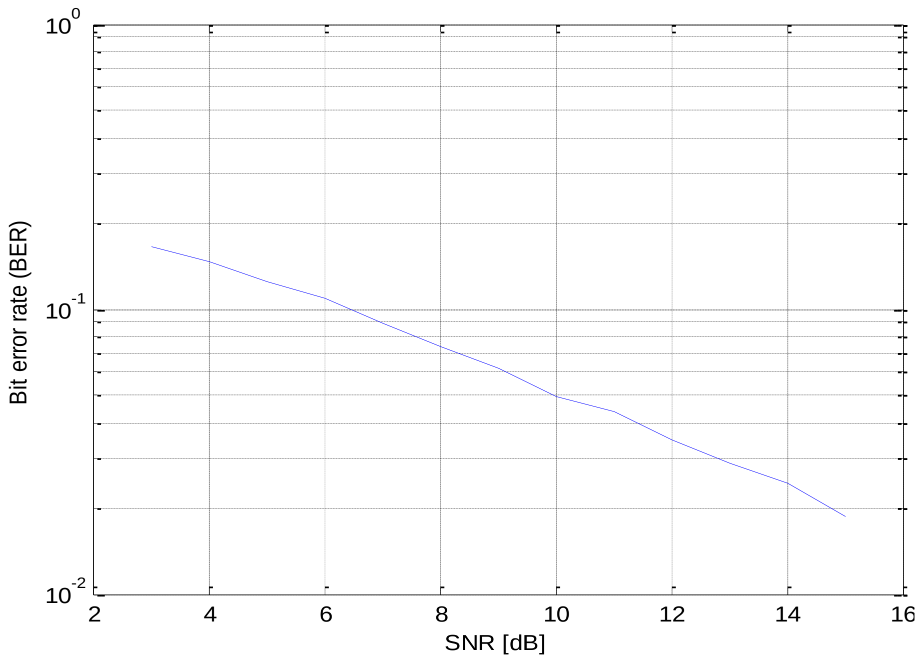

Fig: 7: Bit error rate (BER) v/s SNR

V. CONCLUSION & FUTURE WORK

We have compare pilot based estimate & CRB, Semi blind estimate & CRB along by using Gaussian and QPSK modulation technique. In which semi blind estimate provide better result as compare to other technique. As we increase SNR along X-axis Mean Squared estimation (MSE) get reduce along Y-axis. Comparison between Bit Error Rate (BER) & (SNR), in which bit error rate get reduce along Y-axis as we increase SNR along X-axis.The resultingGMLGaussian Maximum likelihood estimates were obtained numerically using the BFGSalgorithm. We also derived conditions for the optimality ofthe training pilots and provided examples of pilot vectorsthat satisfy them. As performance benchmarks, we derivedthe semi-blind and pilot-based CRBs. We then used simulationstudies to compare the proposed semi-blind estimatorto the conventional pilot-based estimator and showed thatthe proposed estimator provides a substantial improvement inaccuracy. The performance of the semi-blind algorithm closelyapproaches the derived semi-blind CRB as SNR increases. Finally, these performance gains can be achieved at a reasonablecomputational cost, which clearly establishes the merit andpracticality of semi-blind channel estimation forAmplify and forward in Two-Relaying Networks(AF- TWRNs).

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