Comparison and enhancement in channel estimation strategy for next -generation networks using mm wave OFDM channel

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Abstract: This paper develops schemes for OMP, Bayesian Cramer–Rao bounds and ORACLE LS channel estimation in milli-meter wave (mm-Wave) multiple input & multiple output (MIMO) systems that work on spatial complex sparsity inherent in channels. In simulation results shows comparison between ORACLE LS & orthogonal matching pursuit (OMP) on the basis of NMSE v/s SNR. The mm-Wave MIMO whose setup parameters are taken as N_T (No of transmitter) =32, N_R (No of receivers) = 32, N_{Beam}=24, RF = 8, N_{RF} = 8, Nc l = 5 and G = 32. Simulation results shows the improvement in the performance of the proposed ORACLE-LS based channel estimation techniques gives better estimation performance in the compare to the popular OMP based technique.

1. INTRODUCTION

MASSIVE Multiple Input Multiple Output (m-MIMO) are best method for the future 5G technology. It is applying an more numbers of antenna on the Base-Station (BS). It is providing the implementation of the high order throughput in the wireless communication. the order is to be increase the data speed with accurate measurement in channel estimation is compulsory. Hence,

The researchers are providing a lots of research work on the channel estimation for MIMO-OFDM systems, recently [2]– [7]. To minimize these design challenge, hybrid beam forming techniques have been explain in paper [3], [4] which is trade off performance in minimize hardware complexity by using less numbers of radio-frequencies (RF) chain in comparison to the total numbers of antenna. The accurate channel- state-information (CSI) is a main parameter for identify the high gain join with the mm-Wave communication and therefore, efficient schemes for accurate channel estimation are basic need of technique.

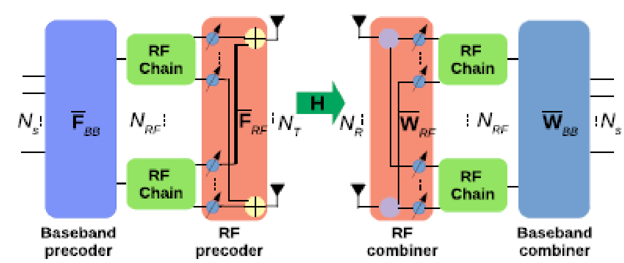


Figure1: Schematic diagram of hybrid signal processing in mm-Wave MIMO system

Therefore, sparse signal estimation recovery technique [7], [8] can be normally apply to provide high accurate channel estimation for such a spatially sparse complex channel.

2. LITRATURE REVIEW

This paper is work in [8] describes a spatial grid based orthogonal-matching-pursuit (OMP) scheme with the proper choice of the RF and base-band precoder matrix. This paper is also focused on the estimation of time selective mm-Wave MIMO channels. This is work in [11] develops a diagonal search OMP technique for estimation of the mm-Wave channel statistics in time the varying environment. Channel estimation in mm-Wave MIMO systems is complex because many antennas & the small signal to noise ratio (SNR) priority to beam forming [3], [5]. The conventional methods for channel estimation, the least-squares (LS) based estimator are ineffective. The latest researches have overcome this technique by the spatial sparsity inherent in the mm-Wave MIMO-based channel, which is develop due to highly unidirectional nature of propagation at mm wave frequencies to develop sparse channel estimation schemes for technique [5], [6], [7]. The work in paper [8] explain the spatial grid based on orthogonal-matching-pursuit (OMP) scheme with an appropriate of the RF & base band signal & pre-coder matrices. The scheme is based on a greedy algorithm selection in the columns of the dictionary complex matrix corresponding to the spatially active channel components, while reducing the related error.

3 MATHEMATICAL ANALYSES

ALGORITHM 1

FOR OMP ESTIMATION

1. Set initialize value t=32; r=32; num RF=8; N_Beam=24; G=32; ITER=10; L=5; omp_thrld=10;
2. Set kp=zeros (t*r,L); SNRdB=10:10:50; mseOMP= zeros (length (SNRdB),1); mseGenie= zeros (length (SNRdB),1); CRB=zeros (length (SNRdB),1);A_T=zeros(t,G);A_R=zeros(r,G);
3. Set loop I=1: G, for K=1: t.
4. Applying Formula
DirCos=2/G*(I-1)-1;
A_T (K,I) =1/sqrt(t)*exp(-j*pi*(K-1)*dirCos);
A_R=A_T;
5. Set Loop ix=1: ITER, I=1: L.
6. Applying Formula
ChGain=1/sqrt (2)*(randn (1, 1)+1j*randn(1,1));
H= H +sqrt (t*r/L)*chGain*A_R (: ix2)*(A_T (:,ix1))';
ChNoise= 1/sqrt(2)*
7. Apply OMP Estimation Technique
Set loop i_SNR=1: length (SNRdB)
snr=10^(SNRdB(i_SNR)/10);
y=sqrt(snr)*Q*H(:)+ChNoise(:);
Qbar=sqrt(snr)*Q*(kron(conj(A_T),A_R));
h_b_omp=OMPmmWave_Est(y,Qbar,ompthrld);
H_omp=A_R*(reshape (h_b_omp,G,G))*A_T';
mseOMP(i_SNR)= mseOMP(i_SNR)+ ((norm (H- H_omp,'fro')) ^2/(t*r)).

In these algorithms having 32 number of transmitters & receivers with 8 radio frequencies carriers. The threshold value of omp set to be 10dB with length 5dB. On applying Estimation technique using base station to increase throughput in communication channel. In conventional Estimation techniques are based on least square (LS) which are ineffective due to large signal to noise ratio. Here, we have applying cluster-based channel estimation technique using omp.

ALGORITHM 2

FOR ORACLE LS ESTIMATION

1. Set initialize value t=32; r=32; numRF=8; N_Beam=24; G=32; ITER=10; L=5; omp_thrld=10;
2. Set kp=zeros (t*r,L); SNRdB=10:10:50; mseOMP= zeros (length (SNRdB),1); mseGenie= zeros (length (SNRdB),1); CRB= zeros (length (SNRdB), 1); A_T=zeros (t,G);A_R=zeros(r,G);
3. Set loop I=1: G, for K=1: t.
4. Applying Formula
DirCos=2/G*(I-1)-1;
A_T (K, I) =1/sqrt(t)*exp(-j*pi*(K-1) *dirCos);
A_R=A_T;
5. Set Loop ix=1: ITER, I=1: L.
6. Applying Formula
ChGain=1/sqrt (2) *(randn (1, 1) +1j*randn(1,1));
H= H +sqrt (t*r/L)*chGain*AR (: ix2)*(AT (:,ix1))';
ChNoise= 1/sqrt (2) *

7. Applying ORACLE LS Estimation Technique
Q_ORACLE=sqrt(snr)*Q*kp;
chGainEst=pinv(Q_ORACLE) *y;
H_genie=A_Rgenie*diag(chGainEst)*ATgenie';
mseGenie(i_SNR) =mseGenie(i_SNR) +((norm(H-H_genie,'fro')) ^2/(t*r)).

In these algorithms having 32 number of transmitters & receivers with 8 radio frequencies carriers. The threshold value of omp set to be 10dB with length 5dB. The mm-Wave MIMO channel is assumed to be spatially sparse with $N_{cl} \in \{5, 10\}$ clusters and $N_{ray} \in \{1, 3, \text{and } 5\}$ rays per cluster. Here, we have applying cluster-based channel estimation technique using ORACLE LS ESTIMATION.

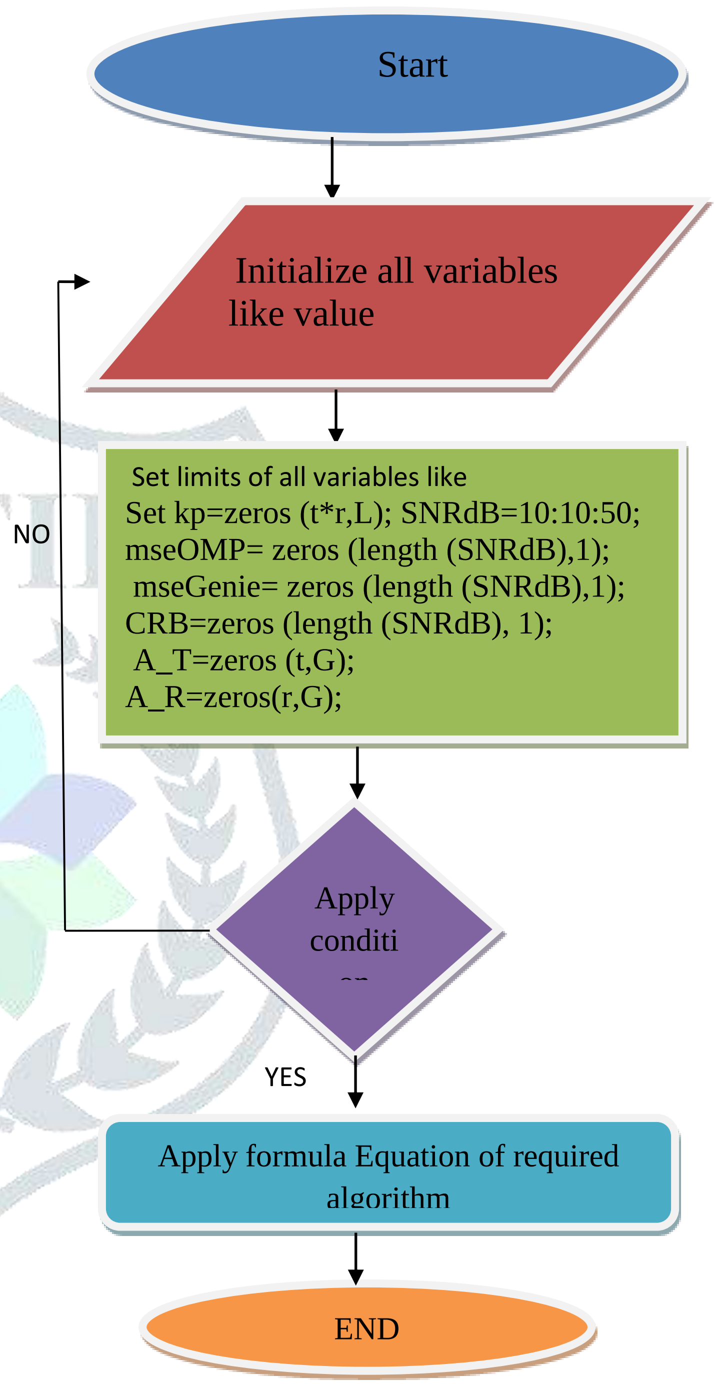
ALGORITM 3

COMPARISION IN TECHNIQUES

1. Set OMP for Nt=32 & Nr=32','ORACLE LS for Nt=32 & Nr=32'. 'Cramer Rao Lower Bound', 'OMP for Nt =16 & Nr=16', 'ORACLE LS for Nt=16 & Nr=16');
2. set x-label ('SNR (dB)');
3. Set y-label ('Normalized MSE');
4. Set title ('MSE Vs SNRdB').

In these algorithms we compare on the basis of number of transmitters & receivers like 16 and 32 for mm-MIMO wireless system without grid match. The various techniques are OMP, ORACLE LS, Cramer Rao Lower Bound estimation techniques. The transmitter and receiver employ are a N_{Beam} (T) = N_{Beam} (R) ∈ {16, 48} pilot beam patterns for channel estimation.The proposed scheme for estimation of the mm-Wave MIMO channel for quasi-static as well as a time-selective scenario. The performance of the proposed ORACLE based approaches is compared with the state-of-the-art OMP-based mm-Wave channel estimation scheme described.

FLOW CHART



4. SIMULATION RESULT

In these simulations result, the number of subcarriers N = 2048 & using 15kHz spacing between of them. The Base Station was settled with the large numbers of antennas as a transmitter and receiver. Moreover, in each transmitter, the interleaved bits are modulated by using 16 Quadrature Amplitude Modulation (16-QAM). A mm-Wave MIMO system with number of transmit and receive antennas set as $N_T = N_R \in \{16,48\}$ and numbers of RF chains $N_{RF} \in \{8,16\}$ is considered. The transmitter and receiver employ are a N_{Beam} (T) = N_{Beam} (R) ∈ {16, 48} pilot beam patterns for channel estimation.

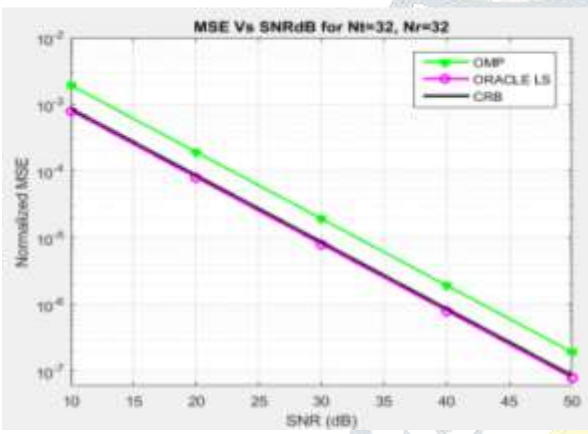


Figure 2: Normalized MSE v/s SNR (dB)

The inter-antenna spacing's of the transmit and receive antenna arrays are fixed as length of antenna for transmitter & receiver $d_T = d_R = \lambda/2$ and the variable value are set for space parameter Φ_R and Φ_T comprises of value G ∈ {10, 32} using angular grid points. The mm-Wave based MIMO channel is considered as to be spatially sparse with $N_{cl} \in \{5, 10\}$ clusters & $N_{ray} \in$ {1, 3, and 5} rays per cluster end. The signal to noise ratio (SNR) in decibels (dB) measured.

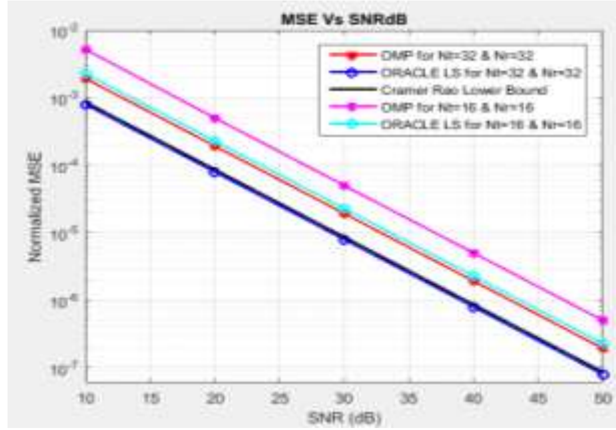


Figure 3: Comparison between various techniques

and G = 10 mm-Wave MIMO wireless system without grid mismatch

Finally, the comparison in achievable spectral efficiency (ASE) with the available estimation of the mm-Wave based MIMO channel it is comparison for the various schemes explained in these paper.

5. CONCLUSION

Simulation result shows the improvement in performance of the proposed ORACLE LS-based channel estimation techniques gives better performance in comparison with the popular orthogonal matching pursuit (OMP) based scheme. In simulation results shows comparison between ORACLE LS & orthogonal matching pursuit (OMP) on the basis of NMSE v/s SNR comparison between orthogonal matching pursuits OMP, MSBL, and TSBL-based technique.

6. REFERENCES

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