An efficient pre-coding TDD-Massive MIMO system for 5G networks

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1. Introduction

MIMO technology was first tested in point-to-point MIMO, where multiple transmitter antennas communicate with multiple receiver antennas and provide significant performance improvements in terms of data rate and transmission stability over wireless systems, One entry and one exit. However, in point-to-point MIMO the complexity of the devices and the power consumption of the signal processing unit on the transmitter and receiver side increase [1]. Also, it cannot be extended and spread is inappropriate. Massive IMO technology has been suggested as a gradient solution. A system in which a BS antenna base station serves multiple antenna user groups at the same time, each with one antenna on the same frequency source as shown in figure 1.

The basic advantages offered by the features of massive MIMO can be summarized as follows:

The additional antennas that make up Massive MIMO by focusing on transmitting and receiving signal...
energy help in a very small spatial region. This greatly improves performance and energy efficiency. Other advantages of MIMO include the use of low-cost and low-power components, low latency, MAC simplification; layer strength, and intentional interference and interference.

The main benefits provided by MIMO features can be broadly summarized as follows.

- Big Capacity: The large capacity MIMO can increase the capacity more than 10 times. The increase in capacity comes from the aggressive spatial multiplexing used in MIMO widely [1] [2].

- Energy Efficiency: The basic principle for greatly improving energy efficiency is that a large number of antennas can be used to focus energy very clearly on a small area of space [3] [4] [5] [6].

- Improved durability and reliability: MIMO technology uses a large number of antennas to provide more diversity gains than propagation channels can provide. Unlimited noise, rapid fading and intercellular interference disappear as the number of antennas increases indefinitely [3] [8]. The result is improved performance in terms of data rate or link stability.

- Simple linear processing: Since the base station uses a large number of antennas, the simplest linear pre-detector and detector are optimal [1] [4]. Massive MIMO can be built with low-cost and low-power components. It uses hundreds of inexpensive amplifiers in the milliwatt range. Some very expensive and bulky items, such as large coaxial cables, can be removed completely [3]. Many of the recently developed wireless standards include MIMO technology. System designers not only can use MIMO to design platforms that can provide improved signal performance to system users, but they have also found more exciting possibilities to take advantage of the random nature of MIMO systems to improve overall safety.

One of the key technologies for achieving massive MIMO 5G performance is Multiple Input and Multiple Output, also known as Big MIMO System or Broadband Antenna System, Ultra Large MIMO, Hyper MIMO, Full Dimension MIMO. Massive MIMO is a technology that can provide a uniformly superior service to wireless cells in high-traffic areas. The central concept of MIMO is used to install multiple antenna groups in one base station to serve multiple mobile stations simultaneously. "Massive" refers to the number of antennas, not their physical size. The antenna array has an attractive shape factor. In the 2 GHz range, the half-length square matrix with 200 co-polar elements is approximately 1.5 x 0.75 meters. Now imagine that the same amount of antenna is in the 20 GHz band. The same array with 200 double-polarized elements will fit in to a board approximately 10 x 10 cm in size, which is one of the reasons why 5G moved to a much higher frequency band[11-15].

![MIMO communication Link](image)

Fig. 1. MIMO communication Link

Unlike traditional encryption-based computer security methods, PLS is an active research topic aimed at increasing the security level of communication systems. PLS offers the most benefit from a wireless security point of view due to a confidentiality issue due to the nature of the transmission of wireless media. PLS provides a better understand not only security but also wireless channel unique
properties. Radio channels are generates interference on signals, fading noise that degrades the received signals[1][8].

The objective of proposed work apply the pre-coding technique with consideration of Time Division Multiplex(TDD) based access the Massive MIMO antenna system from both multiple transmitter and receivers. When function of Massive MIMO the observation of various parameters are analyzed with various parameters and necessary of earlier work[1-9].

2. Method

2.1. Back ground work

Several recent studies have focused on developing backlink interference management plans [15] and [16] and back link delay solutions [6]. In [7], a strategy for interference management for small self-organizing cells was proposed. The Small Cell Base Station (SBS) acts as a front-end decoding and relay for total cell users and passing uplink traffic through the heterogeneous return network to the Total Cell Base Station (MBS). The problem is formulated as a non-cooperative game, and an enhanced learning approach is used to find balance.

He proposed a dual-spectrum and spectrum exchanger based on Reverse Time Division (TDD) and dual channels of Dynamic Frequency Reuse (SFR) to manage reverse interference. Optimization issues are formulated to allocate returned network bandwidth and improve user communications to maximize network totals [8].

An easy-to-use model was developed in [9] to distinguish the connection delay that end users go through on the downlink, taking into account both wired and wireless return networks. Implementing a high-density small cell network may not be effective without investing in connection networks. Besides other research lines, in several studies looking at a single antenna [10]-[14] and multiple antenna transmissions [5], [6], FD SBS performance gains have recently been analyzed for uplink and downlink transmissions. In [15], after examining the feasibility requirements for the FD process.

In resource management techniques have been developed that jointly allocate downlink and uplink transmissions taking into account the advantages of SI removal and method selection in each resource block [11-15]. The user's transmit power is determined to increase the total aggregate benefit. Another optimization study considers maximizing overall speed performance by co-optimizing sub-bus assignment and power assignment with FD transmission in mind [9]. In [5], downlink performance analysis is performed for K-layer networks where SBS operates in full-duplex (HD) half-duplex mode (HD) or bidirectional FD1 mode taking into account the ideal return network for the Rayleigh and SBS fade channel. To maximize network performance, all BS stations must operate in HD or FD mode. Using the Wyner model, Simeone et al. [14] Analyzes the network speed under single cell processing and RAN cloud operation with regard to HD or FD BS. Knowledge related to a favorable system is extracted from FD BS. In [15], the multiple use gain of multiple-input multiple-input HD (MIMO) antennas is compared with the gain obtained using the FD transmitting antenna. Conditions favoring the use of additional antennas for FD transmission rather than high-capacity HD MIMO connections are discussed. The pre-coding method in [5] is designed for MBS cells and small cells with broad MIMO capabilities (ignore SBS interlayer interference) set at fixed distances from MBS. The pre-encryption method allows for complete rejection of the MBS-related reverse interference associated with this user's SBS service on a particular user.

2.2. TDD-Massive MIMO-OFDM

Massive MIMO works in TDD, duplex time division, and downlink beam formation benefit from downlink radio wave interaction. Specifically, the base station group is training the channel in both directions using channel estimates obtained from the uplink pilot transmitted by the mobile station, because the uplink and downlink channels are reverse-coded in the TDD system. Consequently, the massive MIMO is fully expandable with respect to the number of base station antennas. Base stations in MIMO systems operate independently without sharing payload data or channel status information with other cells [4].

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The huge MIMO solution problems make many of the existing research problems irrelevant, but they face completely new problems that require attention. For example, the challenge of efficiently running many low-cost micro components, the need for an efficient way to get channel status information, allocate resources to newly subscribed mobile phones, and service and power and internal energy antennas to achieve lower overall energy efficiency. Reduce consumption and create new deployment scenarios [4]

There are many myths and misconceptions surrounding the massive MIMO and its essential characteristics. However, the problem is that the massive MIMO system is moving to the receiver which is impossible without 5G technology[12].

Beam Formation As a massive MIMO, beam forming, also known as pre-coding, is an integral part of 5G. How beam formation works is explained in detail in section IV, but let's take a quick look at what is beam formation. In essence, the modulation of the beam is essentially a frequency management where the base station or the mobile station transmits information simultaneously using multiple antennas[13].

Unlike pure hardware, massive MIMO, ray formation is a mathematical algorithm based on MIMO mega. By transmitting a variety of signals, also known as pilots, the beam formation algorithm can examine and correct the transmitted signal. This will help you determine the ideal path your signal should follow to move from point A to point B. This greatly improves the efficiency and performance of uplink and downlink signal to noise ratios, also known as SNR, and greatly improves the overall network capacity. Beam forming is basically an advanced algorithm that tracks multiple signal parameters like base station or mobile station location, speed, distance, signal-to-noise level and traffic type[16].

This gives the algorithm a greater advantage in improving the signal. The beam formation function within the algorithm forms a beam towards the receiver. All or some antennas transmit the same signal, but each antenna transmits it with a specific distorted phase. When these various transmitted forms are carried in the air by the normal interference of electromagnetic waves, they form a so-called “virtual” beam, as shown in Figure 2, which is essentially a signal to the receiver. When the beam is blocked by another receiver, it collides more than one phase and the signal deteriorates beyond rebuilding. Beam forming has many advantages over normal transmission[1].

In Figure 2, we can see that the beam formation has a higher signal-to-noise ratio, because directional transmission can greatly improve the link budget and improve the open area and penetration range inside. The formation of the beam is also useful in pruning 3nting and rejecting interference. Using the spatial characteristics of the antenna, it outperforms the internal and external interference of the common channel, also known as the CCI. Essentially, the efficiency of the network increases. By greatly reducing interference into the common channel, massive beam formation using
MIMO allows for a more dense mode than single antenna systems. The ability to operate highly-arranged modifications such as 16QPSK greatly improves the overall system capacity [5].

2.3. Developed System Model

Improved Radio Access Network)RAN bandwidth allocation between wireless return link and access link and time allocation between DL and UL operating ranges to further improve system performance as shown in process of the system model figure:4. The model consists of set of various sub blocks of massive MIMO are cascaded. Improve the over performances a combinations of different algorithms are applied in an order, detailed mathematical modeling of proposed model has expressed in section:5. With this parameters are improved are discussed. We perform the analysis in a large system and extract approximately a specific system total rate (SR), which depends only on statistical information from the channel. The contributions of this study are provide a system model where bandwidth and time are allocated simultaneously to maximize the system SR. Design additional transport protocols and use advance detection and coding techniques to mitigate interference. Specifically, in the system, the RAN shares the same spectral resources perpendicular to that occupied by the wireless connection. The transmission MUE, SUE UL, and DL are reversed.

Also, although projection-based RZF pre-coding is used in DL, LMMSE co-detection is applied to UL to mitigate interference. Concise and deterministic formulas for specific transport protocols are derived as close results from Comfortable DL and UL SR with consideration of incomplete CSI, projection technology and inter-layer interference. Unlike traditional work where DL and UL SR rely on rapidly changing vanishing on a small scale, these deterministic methods rely only on statistical channel information. Unlike [7], various interference mitigation methods are designed for DL and UL transmissions. The coding matrix used in this study is an extension of [8] considering that the CSI is incomplete.

Interference between UEs that share the same frequency source is an important factor affecting system performance and is often overlooked in other studies[11-16]. Formulating an approximate problem that replaces the original problem on a comfortable RS basis based on sharp and conditional formulas, which greatly reduces computational complexity due to the average Monte Carlo. An algorithm was proposed to find the optimal time and bandwidth resource allocation factor for the system's SR speed is increased. We also look at important factors affecting bandwidth and time improvement, such as MUE number and distance[1].

Multiple wireless input and multiple output (MIMO) systems use PLS technology to increase their capabilities by providing the appropriate channels needed to reduce receiver degradation. Therefore, researchers and designers can design using additional channels of high quality reception.
PLS technology focuses on adding channels to MIMO with low power consumption and high security to the intended signal receiver [11].

MIMO with PLS technology has been widely regarded as an improved security strategy for small devices. Small, next-generation devices that use a lot of energy and cannot use traditional complex mathematical encryption algorithms, especially the Internet of Things, require less security. This chapter presents PLS details: It offers many PLS technologies based on multiple antenna systems, including those in which the physical layer corresponds to a larger data communication protocol structure [2][6].

2.4. Singular Value Decomposition (SVD)

The channel capacity of the MIMO system can be obtained using linear algebra. An analysis technique known as single value decomposition [5]. SVD A mechanism developed by which the MIMO channel matrix can be decomposed in several SISO spatial parallel channels. The SVD process of the MIMO system showed that the total number of channels due to the decomposition H is in the same order when looking at the MIMO channel model.

\[ Y = HX + N \]  
(9)

the SVD of H is

\[ H = U \Phi V_H \]  
(10)

Where U is the unit matrix MR x MR and V is the unit matrix MT x MT and \( \Phi \) is the matrix x diagonal matrix diagonal for the single values of the matrix H in descending order

\[ \Phi = \begin{bmatrix} \lambda_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \lambda_M \end{bmatrix} \]  
(11)

where \( \lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_{M-1} \geq \lambda_M \). with CSIT, coding scheme It is applied to the data flow vector X applied before transmission. The code sent

\[ S = Vx \]  
(12)

The received signal vector Z resulting from is multiplied by Y and \( U_H \)

\[ Z = U_Hy \]  
(13)

and to simplify further

\[ Z = U_H(Hs + N) \]  
(14)

\[ Z = U_H(Vx) + N \]  
(15)

\[ Z = \Phi X + U_HN \]  
(16)

\[ Z = \Phi X + \tilde{N} \]  
(17)

Assuming the channel is a Gaussian channel, the factor X. It is a Gaussian variable that is distributed user3nly (i.e. independently) [13]. in a

The signal from the \( j_{th} \) receiving antenna is as follows.

\[ r_j = \sum_{i=1}^{M} h_{ij} x_i + N_j \quad i = 1 \ldots M \]  
(19)
Where $h_{ij}$ is the channel response between the $i$th transmit antenna and the $j$th receive antenna, $r_j$ is the received signal at the $j$th antenna, $x_i$ is the symbol transmitted from the $i$th antenna, is the noise signal at the $j$th receive antenna. In matrix form equation (8) becomes,

$$R = HX + N$$

Where $R = [r_1, \ldots, r_{M_t}]^T$, $X = [x_1, \ldots, x_{M_t}]^T$, $N = [N_1, \ldots, N_{M_t}]^T$, and $H = (h_{M_t1}, \ldots, h_{M_tM_r})$

The channel matrix $H$ can be normalized and equation (21) can be given as:

$$Y = \sqrt{\rho}HX + N$$

Where $\rho$ is the Signal to Noise ratio (SNR):.

If the channel status information (CSI) is unknown to the transmitter and the signal strength transmitted from each antenna is assumed to be the power $E_{M_t}$ So then Channel capacity

$$C = \log_2[I_{M_r} + M_{pt}HH^T]$$

$H^T$ is the transpose conjugate matrix of $H$ and $I_{M_r}$ is $M_r \times M_r$ identity matrix.

When the receiver knows the channel status information (CSI) and uses one The decomposition technique, equation (23), is:

$$C = \sum \log_2[1 + M_{pt}\lambda_i]$$

Where $r$ is the channel matrix range given by $m_i (M_t, M_r)$ and $\lambda_i (i = 1, 2, \cdots, r)$ which is a positive subjective value of $HH^T$. In equation (10), the amplitude of the MIMO channel is the sum of the input channel's single input capacity (SISO), and each energy gain $\lambda_i (i = 1, 2, \cdots, r)$. Power transmission $E_{M_t}$

The capacity of a SISO channel is given by

$$C_{SISO} = \log_2(1 + \rho)$$

For an orthogonal MIMO channel and where $M_t = M_r = M$ then the channel capacity is given by:

$$C_{MIMO} = M \log_2(1 + \rho)$$

From equation (25) we can conclude that the power of the MIMO system is greater. SISO system. This is obtained using spatial multiplex technology. If both the transmitter and the receiver have a CSI, then the channel capacity is: It is determined by the water filling algorithm according to the rules in which more energy is assigned. The channels are in good condition with little or no channels [13].

2.5. Channel Estimation

The composition presented in Figure is for a CSI estimate based on prior figure can be considered. A semi-stable and static fading environment for the Each user has one antenna that sends
a series of power training codes. The result is an experimental matrix for transmission $K \times P$, indicated by this BS signal, which is the matrix $K \times K$ with the noise $N$ given by the signal $SP$

$$R_p = \sqrt{\rho} HSp + N$$

(26)

Where $\rho$ is SNR and $H$ is the channel matrix $M \times K$ and $N$ is the reception noise $M \times P$. Matrix. Under the assumption of semi-static fading, the channel is assumed to be constant $P$ During the formation period. There are other channel estimation techniques used in MIMO systems. It is discussed here. here they are:

### 2.6. Maximum Likelihood Channel Estimation

Use of the received signal in equation (26) and the maximum probability (ML) In the description, the rated channel is given by [4]:

$$H_{ML} = \arg \min \| R_p - \sqrt{\rho} HSp \|^2$$

(27)

Find the derivative of the equation (27) with respect to $H$ and determine the result. If you set the equation to 0 and solve the equation $H$, then the estimated channel is

$$H_{ML} = (R_p \sqrt{\rho} SpH)(SpSpH)^{-1}$$

(28)

### 2.7. Least Squares Channel Estimation

In Least squares channel estimation, the channel $H$ is estimated by taking a value that minimizes the squared error between the actual receive signal, $RP$, and the estimated received signal, $R_p = \sqrt{\rho} HSp$. The estimated channel is given by [4]:

$$\hat{H}_{LS} = \arg \min \| \hat{R}_p - R_p \|^2$$

(29)

Taking the partial derivative of equation (28) with respect to $H$ and setting to zero, then the estimated channel becomes:

$$\hat{H}_{LS} = (R_p \sqrt{\rho} SpH)(SpSpH)^{-1}$$

(30)

The comparison between equations (28) and (30) gives the maximum value The probability and the least-squares channel estimator is the same

### 2.8. Linear Minimum Mean Square Channel Estimation (LMMSE)

LMMSE Channel matrix that reduces the mean square root error between the real and real channels. Channel Rating $H$. For LMMSE, the matrix $H$ Linear overlay of received signals. This assumption can be expressed

### 2.9. Modelling of multiuser detections:

$$h_{ij} = \sum_{k=1}^{P} r_i(k)w_{ij}$$

(31)

For channel elements $h_{ii}$, $i$, $k$th of the matrix, reception matrix elements $RP$ and $w_i$, and elements $H_{ij}$, $r_i(k)$, the values are the actual values and estimates $H$. Equation (31) can be written in general form as follows

$$\hat{H} = R_pW$$

(32)
Where \((i, k)\)th element of \(W\) is \(w_{ij}\). The LMMSE estimate of the channel given by:

\[
H_{\text{LMMSE}} = \arg \min E[\|H - \hat{H}\|^2] \tag{33}
\]

Assume that \(H\) and composed are complex and independent Gaussian components. If the mean and variance of the unit is 0 and take the partial differential equation (33) as The estimated channels for \(W\) are:

\[
H_{\text{LMMSE}} = \left(R_P \sqrt{\rho (I_P + SpS_p) - 1}S_{PH}\right) - 1 \tag{34}
\]

\(I_p\) is the identity matrix

2.10. Linear Precoding Techniques

Figure 4 explains the pre-coding system. The powder device \(T\) is the matrix \(Mr \times Mt\). It is used to set the given data matrix \(D\) (\(Mt \times 1\)) to the matrix \(X\) (\(K \times Mt\)). The received signal can be written as:

\[
y_j = h_j \sum_{i=1}^{k} T_i d_i + N_j \tag{35}
\]

Where \(h_j = (h1j, h2, \ldots hMj)\)

The signal vector received at the \(j\)th user is given by:

\[
y_j = h_j T_j d_j + h_j \sum_{i=1, i \neq j}^{K} T_i d_i + N_j \tag{36}
\]

The general form equation (36) can be written as:

\[
Y = HD + N \tag{37}
\]

Where \(X = TD\)

Then,

\[
Y = HTD + N \tag{38}
\]

To accurately receive data at the receiver, channel matrix \(H\) precoders by must be canceled by Matrix. Some techniques used pre-coding is described below

2.11. Maximum-Ratio Transmission (MRT)

The Maximum-Ratio Transmission (MRT) is also referred to as a matched filter or conjugate beam forming. The precoding matrix \(T\) is given in [15] by:

\[
T = H^H \tag{39}
\]

2.12. Zero Forcing (ZF) Pre coding

ZF uses the pre-encoding matrix \(T\) to find the pseudo-reciprocal matrix \(H\). The combined channel leads to interference-free reception. Pre-coding matrix \(T\)

\[
T = H^H (H^H H) - 1 \tag{39}
\]

3. Results and Discussion

Packet modulation in PLS systems functioning are discusses PLS packet transmission and reception techniques. Simulation using MATLAB for SIMO and MISO systems are implemented and the results are analyzed. The effect of this simulation on the error rate of potential spies is clear. It also
describes the possibility of reducing the transmitter power in RX modulation. Transmission packet transformation the purpose of beam transfer for PLS is to ensure that the intended receiver has a better SNR rate than appears when user 3 is clicked [12]. In the modulation of the transmission beam, the signal is sent to the wanted receiver by multiplying the information codes transmitted by each transmitting antenna in the collector holding the required receiving channel. This allows multiple signals to be received at the wanted receiver and combined to increase the signal-to-noise ratio of the receiver.[13].

Results of transmission beam modulation simulation shows a comparison between a 2 × 1 MISO system and a SISO system using beam transmission modulation. This simulation uses QPSK modulation, and CSI-based transmission beam formation for User2 and User3 can result in improved BER rate for User3, but EER's BER is no better than SISO's theoretical performance. The resulting SNR gap between User2 and User3 supports the concept of using a transmission packet configuration to provide an equivalent user3 BER of security between User1 and User2 between User1 and User3. The resulting plot also continues to increase the SNR gap as the value of SNR increases, reinforcing the potential secret available between User1 and User2. Figure 5: BER and User3 simulation BER simulation using SISO theory comparison. Figure 6 shows this fully. Here, BER results are provided for User2 and User3 for situations in which transmission beam modulation and 2 x 1 MISO are used without beam modulation. Planned SNR ranges are same for User3 performance remains the same.

User1 front beam formation is based on User2's CSI, so User2 is expected to significantly improve User1 beam formation performance, while User3 does not benefit from ray formation. Once again, the SNR gap increases the user3 BER of security between User1 and User2. For example, BER User3's is twice more than User2 at SNR of 20dB. Figure 7: Diagram of User2 and User3 BER simulation with or without Beam TX; the received signals are combined to improve the overall signal-to-noise ratio (SNR). If the receiver contains multiple antennas, then the signal processing technique known as the maximum ratio combination [4] can be used. The receiver has antenna signal processing technology known as the maximum ratio.This combination can be used if the receiver contains multiple antennas [4]. Since the receiver contains multiple antennas, it detects signals transmitted over multiple paths [5]. The receiver manages the signal quality for each weighted path accordingly. Step-by-step signals are merged into steps that increase diversity gain [6]. The resulting combined signal is passed to the extraction.

Expected BER performance for the receiver when comparing a MISO 2-in-1 transport packet with a SIMO 1x2 system using MRC. Theoretical results of the SIMO 2 x 1 system were extracted for comparison. Built-in receivers for transmitting beamform and bit-rate performance (BER) mentioned by MRC support the theory that a transmitter can use a single transmitting antenna instead of multiple transmitting antennas to transmit the beam. The construction of the transmission beam increases the complexity of the transmitter, which increases the processing requirements. The complexity of the process in general means an increase in the power consumption of the transmitter. The results of this simulation indicate that the receiver can use MRC to reduce the complexity of the transmitter. This approach can improve the operational stability of small IoT devices with limited battery capacity.

Artificial Noise The artificial noise technology means that the creator User1 generates artificial noise and transmits it in all directions other than the intended direction. User1 can improve the overall effect of user3 if user 1 knows user3 Channel status information and does not generally recognize eavesdropping manually. The desired result of AN generation is the reduction of a possible intercept channel without affecting the quality of the intended receive channel. Even in scenarios where SNR is increasing in user3, it is worth noting that the increased SNR in user3 not only provides a stronger informational signal, but also preserves the secrets provided by the increased artificial noise you notice. The AN simulation series performed in this document using the transmission beam transmission model shows in the figure 5.

Artificial noise simulation results in Figure 5, simulation results are presented for a single 2x1 input output system, with the percentage of total transmission power assigned to setting the AN setting to 30%. This figure shows that an AN has not been created, the BER in User3 has increased significantly compared to 30% of the energy used for AN compared to BER. As a result of the User1 TX beam formation, User3's BER rate increases by 0dB or more from User2's BER rate in the SNR region, but the free effect appears due to the presence of AN. For example, at a 35dB SNR ratio, User3's BER rate increased from about 10-5 to 10-1, and it already appears to be 10-1 for all SNR.
values greater than 10 dB. For User3, the higher the value of SNR, the more observed SNR for the signal containing information, while SNR for AN also increases, leaving User3 without utilizing the SNR system.

On the other hand, User 2's bit rate (BER) is slightly affected by the written AN based on User 2's CSI, but a function of the total transmission power allocated to the signal without information is reduced to 60% compared to 100% when AN is not created. As the energy allocation of the AN increases further, as shown in Figure 5, Figure 6, and, the user's BER rate continues to reach 10-0.5 with the ability of AN. The stake is 60%. However, the decrease in the energy allocation to the information transfer signal also begins to influence User2's BER rate. This looks fine in Figure 4 since bit error rate User2 is higher than bit error rate in User3 once AN does not apply to SNR values less than 10dB.

The recipient's corresponding BER performance for both transmission beam modulation and MRC concept is useful to one transmitting antenna instead of many transmitting antennas form the transmitting beam. The complexity of transmitter is increases due to unique configuration of the transmission beam, which increases the requirements of processing. Power consumption increases due to the high degree of difficulty of the process. With help of MRC simulation results at the receiver to reduce the complexity of the transmitter and increase the operational reliability with limited battery capacity. So the proposed method is best suitable to 5G IOT design[9]

Maximum transmitter power reduction ratio as small portable IoT devices expand, and overall power restrictions are limited, it is important to keep an acceptable BER error rate at a reduced SNR rate using RX beam forming technologies such as MRC. MRC simulation is implemented to better demonstrate that MRC can be used to provide the required bit rate at a lower SNR. Again, the Rayleigh plane fading is assumed as in the transmission beam modulation simulation.

Maximum percentage of combined simulation results Figure 6 shows simulation results with integrated MRC. The MRC supports the comparison of receiver if a 2-in-1 MISO transmission packet to the performance of a 1 x 2 SIMO system and results of the SIMO 2 x 1 system are also drawn.
Simulation results are provided for a single 2 × 1 multi-input output system where the specified percentage of total transmission capacity is set to 20% with AN in figure 5.

This figure shows that when an AN is not generated, the user's BER of 3 is significantly increased compared to the BER of 20% of the energy used in the AN. Due to the formation of the TX packet by User1, the user's BER rate of 3 increases by more than 0 dB in the user's BER rate of 2 for the SNR region, but the free effect appears due to the presence of AN. For example, at a 20 dB SNR ratio, User 3 bit error rate (BER) increased from about 10-5 to 10-1, and it already appears to reach 10-1 for all SNR values greater than 10 dB. For user 3, the higher the value of SNR, the more noticeable SNR is for the retention signal, while the SNR for AN also increases, pruser3nting User 3 from benefiting from a higher SNR rate.

On the other hand, user 2's bit error rate (BER) is slightly affected by user AN value generated by CSI [2]. This is not due to AN, but part of the total transmission power assigned to the signal without information is reduced to 60% Compared to 100% when AN is not created. As shown in Figure 5, Figure 7 and, if the power distribution of AN increases more for user 3 n, then the bit error rate for AN3 is 80% for the AN power assignment. User3r, the way that the retention signal power distribution decreases, begins to affect User BER 2.

We extend the discussion from 2X2 MIMO to Massive MIMO which consists of clusters of based stations each base station can unique number of users. When we consider the CSI of Massive MIMO between the base stations with unique values of users a Null space Projections are used. CSI can be compute by SVD approach. The simulated results are shown in figure:7.

Simulated of the channel estimation algorithm is used to compare the performance of two common algorithms in terms of mean square root error (MSE) and signal-to-noise ratio (SNR). Due to the limitations of the LTE-A simulation system, we focused on comparing the two channel field estimation algorithms. Since this simulation only focuses on channel estimation in the frequency field, DMRS, resource element mapping, IFFT / FFT, distribution, and channel estimation units are taken into consideration when MAC layer processing and some physical correlation functions (such as modulation, layer) will be. Mapping, pre-coding, and demodulation) are not considered in this simulation[11-15].

Figure 8 shows the channel estimation, which is a function of the number of base station antennas for optimum and linear receivers at K =20. A semi-stable and static fading environment for the Each user has one antenna that sends a series of power training codes. The result is an experimental matrix for transmission K × P, indicated by this LS and MMSE. From the equations(31,34) The values are calculated at depicted as shown in figure, It is noted that mean square reduction of proposed method is using MMSE is less value at given SNR to the LS estimation.Also shown in the figures are LS and MMSE doses. Obviously, when M is large, the capacitance is close to the total amplitude of Shannon for the optimal receiver. For example, the optimum receiver and the maximum sum that you can get with M = K = 10 is 9 bits / sec / hz. However, if M equals 200, you can get a total speed of 100 bits / sec / hz with a simple ZF reception.
Figure 9 shows the capacitance, which is a function of the number of base station antennas for optimum and linear receivers at \(K = 20\). Also shown in the figures are ZF and MMSE doses. Obviously, when \(M\) is large, the capacitance is close to the total amplitude of Shannon for the optimal receiver. For example, the optimum receiver and the maximum sum that you can get with \(M = K = 10\) is 8.5 bits/sec/Hz. However, if \(M\) equals 60, you can get a total speed of 38 bits/sec/Hz with a simple ZF reception. (equations 31 and 34).

Figure 10. Performance of systems with number of antennas
The result of the sum of the achievable equations (equation 38) for experimental reuse factors $N = 4, N = 5$ was obtained by MATLAB simulation. For simulation, it can limit the number of users in each cell with any number of authorities. In fact, the number of users in a cell is determined by the time of the interference and the frequency smoothness interval [9]. The number of users in each cell is chosen to divide by the experimental reuse factor. It is a figure: 10 demonstrates simulation results for experimental reuse factors $N = 3$ and $N = 4$ with the number of users in each cell set to $K = 20$. Experimental reuse factor $N = 4$ provides a better realization rate than the experimental reuse factor $N$. For example, for the number of antennas $M = 200$, the average achievable pilot coefficient of $N = 5$ is $0.237 \times 10^{-3}$. This is greater than the value of the experimental reuse factor $N = 4$.

![Fig. 11. Performance of systems with number of antennas](image)

Figure 11 compares the achievable average percentage of pollution = 4 with the achievable average percentage of systems that did not mitigate the effects of experimental pollution (using PCE). In Figure 11, the total achievable average $a_4 = 6.3 \times 10^7$ times PCE. Figures 11, and 12 are shown that the average realizable amount has improved significantly. This is due to the mitigation of the effect of experimental pollution in the proposed method, where a new experimental reuse factor with pre-fade encoding is widely used. All of the above results show that as the number of antennas increases, the achievable speed also increases. It can also be seen that the higher the experimental reuse factor, the average realizable amount was better. This indicates that a large number of antennas provides better speed and represents a huge advantage to MIMO on a large scale.

4. Conclusion

Beamforming technology can be divided into two categories. The first is the transmission beam modulation, which uses the phase shift of the signal transmitted in multiple directions to reduce the level of the signal transmitted in the other direction while focusing the signal transmitted to the four intended receivers. Second, called receive beam modulation, the spatial diversity is used to process multiple signals received from multiple reception antennas to increase the signal-to-noise ratio of the receiver. It also takes into account the potential benefits of reducing the power of the transmitter forming the beam with the maximum combination ratios. AN is used to analyze or study the security issues between the transmitter and desired receiver in order to add AN distributed in desired or unique directions from given receiver. Improved channel estimation and MIMO detection algorithms for low latency are important for the future developed for Massive MIMO. For this reason, this paper the current channel estimation and MIMO detection algorithm for MIMO on a large scale to reduce the computational cost of large-scale matrix computing. The results of theoretical analysis and numerical simulation indicate that MMSE has higher performance with higher complexity compared to LS / ZF with lower performance and less complexity. Channel and MIMO estimation algorithms are analyzed with 5G trends. Analysis of implementation of the current extensions and Single Instruction And Multiple Data (SIMDs) of both algorithms shows the importance of large-scale reflection of the complex matrix in MIMO.
References


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