

An Overview of MIMO Systems in Wireless Communications¹Gaurav Kumar Soni, ²Dimple Jangir, ³Smita Sankhla, ⁴Purva Sakhuja^{1, 2, 4}Department of Electronic & Communication, Arya College of Engineering and Research Centre, Jaipur, India³Department of Computer Science, Arya College of Engineering and Research Centre, Jaipur,E-mail: Indiagksoni2709@gmail.com , dallujangir@gmail.com , smita.sankhla@gmail.com , purvasakhuja@gmail.com**Abstract**

In this paper, provide a general description of MIMO systems in wireless communication systems as a breakthrough in wireless communication technologies. MIMO systems are used to improve channel noise and interference performance. In this paper, the use of MIMO to improve channel capacity and BER was also emphasized. The discussion then evolves towards the progress of this technique in the modern scenario involving the integration of OFDM with MIMO. Using MIMO-OFDM, very high data rates are achieved.

Keywords: MIMO, OFDM, BER, SNR, AWGN.**Introduction**

Multiple inputs Multiple input systems (MIMO) are a natural extension of the developments in antenna network connections. MIMO systems consist of multiple transmit antennas in multiple antennas and receive antennas in the future. The benefits of MIMO communications, which use the physical channel between many transmitters and receive antennas, are currently receiving considerable attention.

MIMO systems offer many advantages over the connection of antennas and antennas. The weak sensitivity decreases due to the spatial separation provided by many spatial pathways under certain environmental conditions. The energy requirements associated with the spectral efficiency connections can be reduced by preventing the theoretical energy of the relevant information from being printed here. Determine the spectrum as the total amount of bits per second hand information from the heart that is delivered from one matrix to another.

Impressive improvements in error rates and Bit Error Rate (BER) have recently drawn attention to multi-antenna systems. Despite the gains, the price depends on the complexity of the equipment. The radio interface has a complexity, size and price equivalent to those of many antennas. This cost can be mitigated by taking advantage of several advantages of MIMO systems through a technology called antenna selection.

Channel capacity increases linearly with RSB when the SNR is low, but increases logarithmically with RSN at a low success rate. In the MIMO system, the total transport capacity can be divided into several spatial paths, which brings the capacity of the linear system closer to each pattern, thus increasing the total spectral efficiency [6, 7]. MIMO systems offer high spectral efficiency with lower power consumption for each piece of information. Channel graph compared to negation. Figure 1 shows antenna elements. The graph shows that the MIMO capability has a linear relationship, while the SIMO / MISO capability has a logarithmic relationship with the number of antenna elements. Therefore, MIMO is the topic of discussion for effective wireless communication

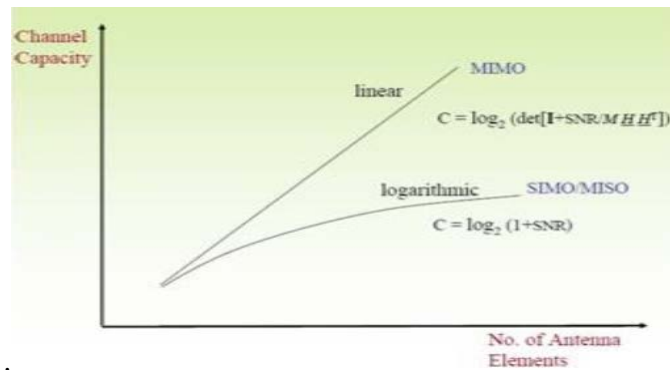


Figure 1 : Graph showing the variation of channel capacity with number of antenna elements

The fourth generation of 4G mobile phone systems is expected to solve outstanding issues for third-generation (3G) systems and offer a wide range of new services, from high-quality voice to high-speed data channels to high speed wireless video. 4G is the multimedia of MAGIC-Mobile, anytime, anywhere, [9]. 4G mobile wireless systems and access control systems has attracted a lot of attention in terms of mobile communications. 4G systems will not only be compatible with the next generation of mobile services, but will also support fixed wireless networks. The characteristics of the 4G system can be summarized with the integration of the word. In fact, 4G technologies must adhere to constant communication with 100 Mbps throughput in the user terminal and other services on which intelligent transport systems operate. CALM [10], a continuous automotive communication, is a new global standard for the use of ITS. This includes radar resurface; GPS and the air interface 2G to support the activities of intelligent transportation systems.

OFDM-MIMO In Wireless Communication

It is envisaged that several systems using multiple antennas in transmitters and receivers will be used to improve the range and performance of telecommunication systems. In addition to the many promising antennas, the current technology is the multi-input system (MIMO). However, with increasing number of transmitters and receivers, MIMO has a lot of capacity. But it is clear that the advantages of the features of the various MIMO receivers can be used. OFDM-MIMO (STC) can increase data performance by increasing the space of the spatial databases being resolved.

MIMO is a wireless connection between the M transmitter and the N-receiver antennas. Consistency is the MN elements that represent MIMO channel parameters. The different antennas of the transmitter / receiver can be listened to or shared by the same modem among different users. The following configuration is called MIMO distribution and collaborative communication. The statistical models of MIMO models provide flexibility in channel selection parameters, temporal and spatial correlation, According to this model, the simulation tool MIMO channel is executed. Different models of MIMO channels have been proposed in [6] and Spatial correlation models were presented by multiplying the unrelated random matrix variables by the square root of the heterogeneity matrix and each based on similar assumptions. However, they differ in their concentration [7].

MIMO System

MIMO uses multiple antennas at the transmitter and receiver to improve the communication performance of the system using a diversity variety and developer. The MIMO system provides superior spectral efficiency, improves reliability, reduces brightness variations and improves interference resistance [2].

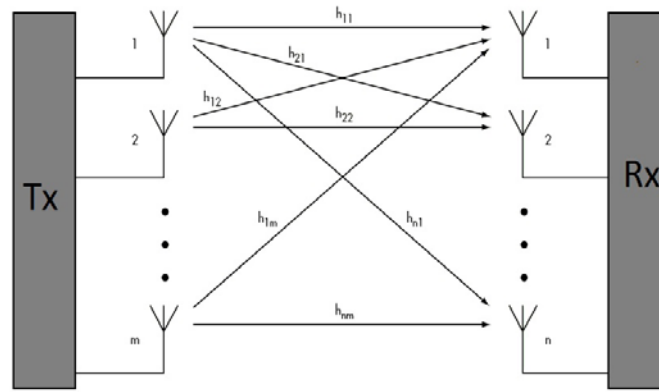


Figure 2 : MIMO System

In the literature, three main MIMO techniques have been proposed, such as spatial multiplexing for pre-encoding and encryption. Precoding is a technology that uses CSI knowledge of the sender and receiver to code multicast packet design in advance. In satellite multiplexing, a high-frequency signal is propagated in each transmitting antenna with different null data streams and each train uses the same frequency band. If the CSI is not available in the sender, different codec can be used to get a better win for multiple MRC systems. In the diversity coding method, the signal sends the spatial temporal encryption application to the sender. Basic MIMO system. This MIMO system includes transmit antennas and receive antennas. The channel between the receiving antenna and the j th transmit antenna is called h_{ij} . Thus, the reception signal can be modelled

$$y = Hx + n \quad (1)$$

When the signal vector x is the signal, the sound vector and H is the channel matrix with the composer. Beam training uses Precoding technology and several antennas to send and receive directional signals [2]. This directional transmission is achieved by multiplying the transmit / receive signal with a Pre code vector to obtain constructive interference in the corresponding direction and destructive interference in other directions. Packet configuration modes can be applied to the sender and recipient more comprehensive knowledge. In addition, the improvement significantly reduces the beam out of trouble in the way of interference-free sealing and system capacity. The Maximum Transmission Rate (MRT) is the packet formation technology that allows both the diversity and the gain of the matrix with the formation of the transmission packet. The MRC is the optimal installation method, in which signals from the receiving antenna are collected in such a way that the SNR is instantly amplified. MRT with MRC provides a reference for optimal performance that the system can achieve by using transmit and receive diversity. When one-way packets are formed, the same signal passes through each of the transmitting antennas after encoding the Precoding with the transmission packet shaping vector. Then, the receive packet transceiver is designed in the same way that the RSB is maximized end-to-end for future inputs. The reception signal can be formulated to form the current single beam

$$y = Hw_1x + n \quad (2)$$

where w_1 is the transmission packet that forms the vector and x is the transmission signal for all antennas. In the receiver, vector vectors are applied to y . This can be expressed

$$\hat{y} = w_r^H H w_1 x + w_r^H n \quad (3)$$

Alamouti has proposed a new form of transmission diversity system using two antennas for transmission when CSI is not available to the transmitter [2]. To do this, first move a pair of icons using two antennas, and then send the converted version of the icons. The Alamouti program discusses advances in time coding technology. In OSTBC, data is sent with orthogonal encryption. Thus, multiple copies of the data are sent to multiple antennas. This improves data transfer reliability. Sending multiple data copies increases the ability to decode the strong signal correctly with the data that is received frequently.

This OSTBC codec uses independent fade in multiple antennas to improve diversity gain. In the sender, the OSTBC encoding is configured to operate with N codes in the row orthogonal row, the X entries obtained by linear combinations being obtained from colligates [1]. In addition, NT is the number of code periods used to send the password. Therefore, the code rate is. Either the signal sent during the kth code period. We take. During the kth blade period, we have a receive signal at destination k

$$y_k = Hx_k + n_k, k = 1, 2, \dots, N_T \quad (4)$$

Where n_k is the noise vector at the destination.

MIMO System Channel Capacity

To mitigate the problem of discoloration due to multipath proliferation, diversity techniques have been developed. Antenna diversity is a generalized form of diversity. Information theory has shown that with multi-pathogens, antennas and multiple synchronous channels simultaneously operating in the same frequency band and with the same overall strong force. The relationship between the antennas varies greatly depending on the dispersion environment, the distance between the transmitter and the receiver, the antenna configurations and the Doppler propagation. This representation is also called spectral efficiency (bandwidth). The capacity of the MIMO channel depends largely on the statistical characteristics and connections of the channel antenna element. The input and the output of a secondary channel of the memory are respectively represented by the random variables X and Y and the capacity of the channel is defined by the maximum number of exchanged information X and Y: the receiver can in principle identify several similarities.

Conclusion

MIMO will ultimately benefit all major wireless sectors, including mobile phones, wireless LAN industries and many other sectors. In addition, the local network sector is at the forefront of mobility innovations. That's why MIMO-OFDM is the basis of all IEEE 802.11n MIMO-OFDM proposals. For the same performance, MIMO-OFDM reaches a range about three times that of non-MIMO systems. This significant improvement in performance, OFDM MIMO makes the range solution ideal not only for the wireless LAN, but also for home entertainment networks and 4G networks. Areas where MIMO technologies add significant value to the wireless system include WLAN - WiFi 802.11n, networks (such as Muni Wireless), WMAN - WiMAX, 4G, Cellular, RFID, Mobile Satellite TV, Satellite Satellite and Digital Home . In general, MIMO exploits several paths through spatial diversity as well as multiplexing techniques. Improving the performance of wireless communications at no additional cost (only adding hardware and complexity) is largely responsible for the

success of MIMO as a new research topic and is therefore an independent topic. MIMO speed is doubled to connect high bandwidth applications such as streaming media.

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