Dynamic Beamforming for MIMO-OFDM

Navyashree, Dr.K.V.S.Ananda Babu, M.Pappa

Student, Dept of Telecommunication, CMR Institute of Technology, Bengaluru, India

Professor, Dept of Telecommunication, CMR Institute of Technology, Bengaluru , India

Associate Professor, Dept of Telecom Medication, CMR Institute of Technology, Bengaluru , India

ABSTRACT: This paper proposes a method for an implementation of beam forming for MIMO-OFDM in LTE technique, Beam forming can be used at both the transmitting and receiving ends in order to achieve spatial selectivity. More over the beam Forming is implemented at the transmitter. The improvement compared with Omni directional reception/transmission is known as the directivity of the element. Beam forming can be used for radio or sound waves.Beamformation for particular angle is done using covariance matrix and Eigen values. It has found numerous applications in radar, sonar, seismology, wireless communications, radio astronomy, acoustics, and biomedicine. Adaptive beam forming is used to detect and estimate the signal-of-interest at the output of a sensor array by means of optimal (e.g., least-squares) spatial filtering and interference rejection. MIMO(Multiple-Output, Multiple-Input) Systems achieves different gains using beam forming, Spatial diversity & spatial multiplexing techniques, spatial diversity & spatial multiplexing techniques, the multi-carrier modulation via Orthogonal frequency facilitating(OFDM) transceiver Structure for broadband communication. In this paper comparison of modulation techniques is done. And comparison of BER vs. SNR of 802.11n Wi-Fi and LTE system is done.

KEYWORDS: Acoustics, Biomedicine, Beam Forming, LTE, MIMO-OFDM, Transceiver, Wireless Communications, Radio Astronomy.

I. INTRODUCTION

As is generally known; long-term evolution (LTE) designed by the third generation partnership project (3GPP) helps operators to provide wireless broadband services with enhanced performance and capacity. A variety of targets and requirements for LTE have been suggested by 3GPP, including higher peak data rates and more UEs per cell as well as lower control plane latency than currently employed 3G architectures. Based on orthogonal frequency division multiple access (OFDMA), radio technology applies various scheduling and multi antenna methods. 3G LTE is further developed to meet requirements set for IMT-Advanced technologies. The role of antenna parameter selection in evolution of 3G LTE-Advanced has been widely discussed currently. As one of the key techniques in LTE-Advanced system, multiple input, multiple output (MIMO) is considered as an effective way to obtain high data rates without sacrificing bandwidth and to improve the performance of both cell edge UE and the whole system. A trend toward deploying larger number of antennas can be noted in the evolution of some.

Standards such as IEEE 802.11n/802.11ac and LTE. With Massive MIMO, huge numbers of elements in antenna arrays are able to deploy in systems being built today. Larger numbers of terminals can always be accommodated by combining massive MIMO technology with conventional time and frequency division multiplexing via orthogonal frequency division multiplexing (OFDM). Massive MIMO is a new research field in communication theory, propagation, and electronics and represents a paradigm shift in the way of considering with regard to theory, systems, and implementation.

Three-dimensional MIMO (3D MIMO) can be seen as an effective method to approach massive MIMO without applying too much antennas on transmitter or receiver. Vertical dimension will be utilized in the antenna modelling, and down tilt of the antennas will become significant channel parameters. A typical two-dimensional (2D) antenna is used to cover a sector of 120 degrees only in horizontal domain. Compared with the 2D channel propagation, scattered is no longer located in the same plane with antennas and is supposed to distribute randomly in three-dimensional space.

We are considering the possibility of extending the current 2D antenna to the future 3D antenna, which means that the departure and arrival angles have to be modelled in two directions, that is, horizontal and vertical.

Beam forming of linear array antenna elements merely in horizontal dimension does not give full free-space gain. This is due to the azimuth spread of the received signal as seen from the base station (BS), which has been extensively investigated in previous studies. It is necessary to propose a novel beam forming algorithm which includes the gain of the vertical dimension. In this paper, we will present a dynamic beam forming algorithm in which vertical difference of 3D antennas will be taken into account. In conventional 2D MIMO scenario, cell edge UEs suffers serious intercool interference from neighbouring cell due to their locations. Since the radio propagation from a transmission node to a UE is divided into horizontal direction and vertical direction, the power of inter cell interference can be reduced largely, which results in an enhancement of the signal to interference plus noise ratio (SINR). Compared with the existing 2D beam forming algorithm, better system performance can be brought by dynamic beam forming algorithm.

The rest of this paper is organized as follows. Section describes the system model of the downlink LTE-Advanced networks and the modelling of 3D MIMO channel. The principle and details of the dynamic beam forming algorithm are introduced in Section, and performance of the proposed algorithm with different configuration parameters is simulated and analyzed in Section. The conclusion of this paper is given in Section.

II. RELATED WORK

Alexandra Ovarian et.al [1] in this paper proposed a Multi antenna & Multi-Carrier wireless transmission techniques are expect to provide high peak data rates & spectral efficiency, good coverage & reliable transmission require by emerging wireless standards such as 3gpp long term evaluation(LTE) & 3gpp LTE-advanced the multi stream transmission via multiple-output multiple-input(MIMO)Systems achieves different gains using beam forming, spatial diversity & spatial multiplexing(OFDM)enhance Spectral efficiency & facilitates using simple transceiver structures broadband communications.

Dr.ThomasL.stewart et.al [2] this program is valuable for future researchers simulating systems that are too theoretically complex to analyze. Single-carrier QAM and multicarrier OFDM are compared to demonstrate the strength of OFDM in multipath channels. Two graphical user interface demonstrations show some of the basic concepts of OFDM.

Massimiliano Ricci et al [3] Beam forming and power control algorithms are investigated in intra-system spectrum sharing for LTE Advanced system (named as Flexible Spectrum Usage, FSU) context. FSU is considered to occupy scarce spectral resources opportunistically in order to increase the average spectral efficiency of the system and to provide less interference to the other system. So, to avoid interference to other systems, beam forming and power control algorithms are investigated and implemented in MATLAB. As a starting point, assuming perfect channel state information at the transmitter, single-user (SU) multiple input multiple output (MIMO) downlink beam forming is implemented to evaluate the link performance of the system. As a case study, a link-level simulator complying UTRAN Long Term Evolution (LTE) standard is considered.

III. PROPOSED SYSTEM

In an OFDM system, the transmitter modulates the message bit sequence into PSK/QAM symbols, performs IFFT on the symbols to convert them into time-domain signals, and sends them out through a (wireless) channel. Before sending the data out from the transmitter through antenna, it should form the radiation pattern called beam forming. We implement the joint-beam forming technique for MIMO system. Once radiation pattern is constructed it will route to the receiver. Receiver will decode the incoming data and transform it to get the data.
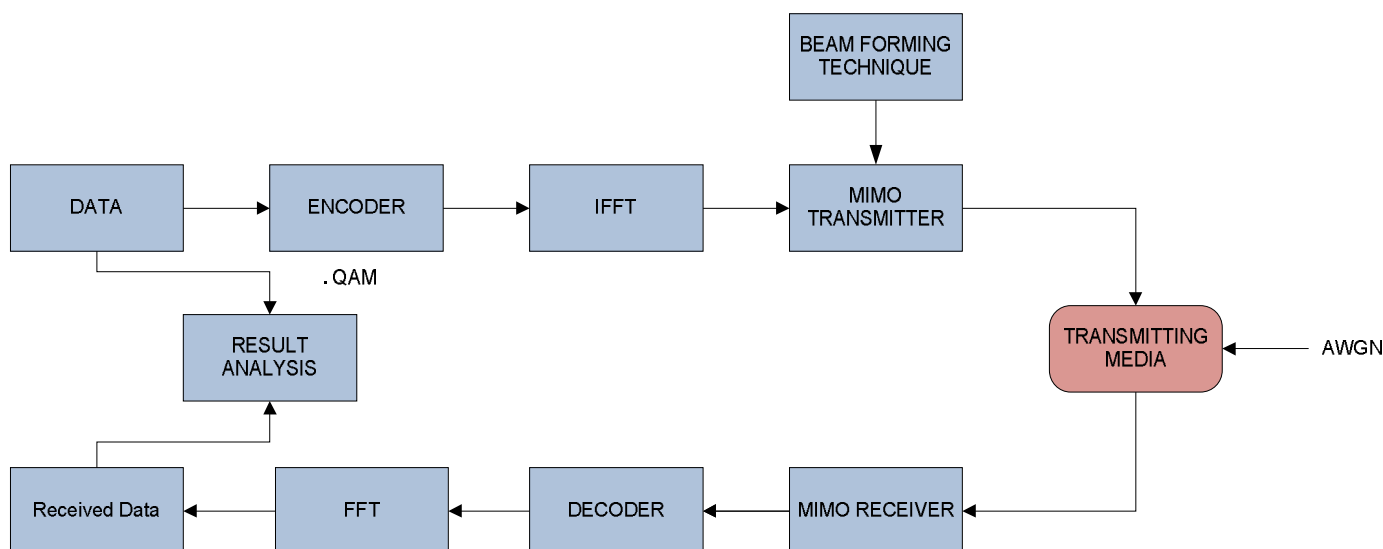
Figure 1: Proposed Architecture

A. Beam forming technique

Multiple-input multiple-output (MIMO) techniques offer many benefits in practical wireless systems including capacity and spectral efficiency increment, fading mitigation, and improved resistance to interference. Beam forming is a multi antenna technique that significantly reduces interference and improves system capacity. An emerging research trend considers relays in terrestrial and satellite Networks, as the most promising proposal for achieving significant performance gains. Enhanced reliability and extended cell coverage are two of the advantages the relay networks offer. Although beam forming techniques at the source and/or the destination in a relay network have been examined, their use in MIMO relay networks has been recently proposed and is expected to overcome crucial obstacles in terms of capacity and interference.

B.MIMO Transmitter:

Multiple antennas can be used at the transmitter and receiver, an arrangement called a MIMO system. A MIMO system takes advantage of the spatial diversity that is obtained by spatially separated antennas in a dense multipath scattering environment. MIMO systems may be implemented in a number of different ways to obtain either a diversity gain to combat signal fading or to obtain a capacity gain. Generally, there are three categories of MIMO techniques. The first aims to improve the power efficiency by maximizing spatial diversity. Such techniques 4 include delay diversity, STBC and STTC. The second class uses a layered approach to increase capacity. One popular example of such a system is V-BLAST suggested by where full spatial diversity is usually not achieved. Finally, the third type exploits the knowledge of channel at the transmitter. It decomposes the channel coefficient matrix using SVD and uses these decomposed unitary matrices as pre- and post-filters at the transmitter and the receiver to achieve near capacity. [5, 6]

B. Feature AWGN

Channel is a universal channel model for analyzing modulation schemes. In this model, the channel does nothing but add a white Gaussian noise to the signal passing through it. This implies that the channel's amplitude frequency response is flat (thus with unlimited or infinite bandwidth) and phase frequency response is linear for all frequencies so that modulated signals pass through it without any amplitude loss and phase distortion of frequency components. Fading does not exist. The only distortion is introduced by the AWGN. The received signal is simplified to

$$r(t) = x(t) + n(t)$$

Where n (t) is the additive white Gaussian noise.

The whiteness of n (t) implies that it is a stationary random process with a flat power spectral density (PSD) for all frequencies. It is a convention to assume its PSD as

$$N(f) = \frac{No}{2}, -\infty < f < \infty$$

This implies that a white process has infinite power. This of course is a mathematical Idealization. According to the Wiener-Khinchine theorem, the autocorrelation function of the AWGN is R (τ) = No/2 δ (τ) (3.18) where δ (τ) is the Dirac delta function.

C. Inverse Fast Fourier Transforms (IFFT)

The IFFT transform a spectrum (amplitude and phase of each component) into a time domain signal. An IFFT [7] Converts a number of complex data points, of length that is power of 2, into the same number of points in time domain. Each data point in frequency spectrum used for an FFT or IFFT operation is called a bin. The Inverse Fast Fourier Transform (IFFT) performs N-Point IFFT operation for the received; The IFFT can be performed by first swapping the real and imaginary parts of the incoming data and then performing the forward FFT on them and once again swapping the real and imaginary parts of the data at the output. This methods allows one to perform the IFFT without changing any internal coefficients and thus, resulting in more efficient hardware implementation.
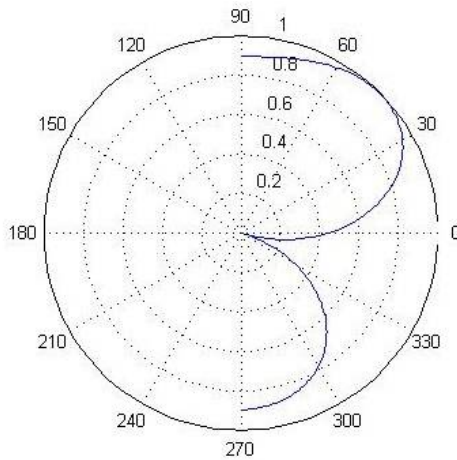
IV. SIMULATION RESULTS

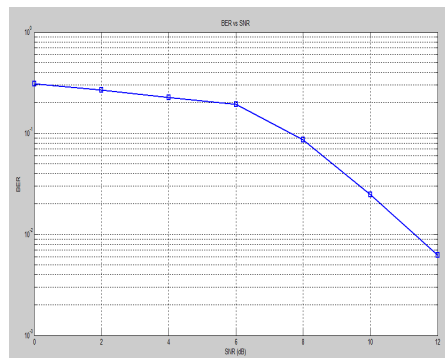Fig.1 Beam formation at angle 45 degrees
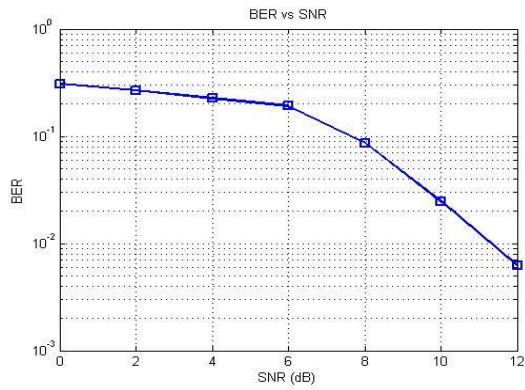

Fig.2 BER visor (QAM)
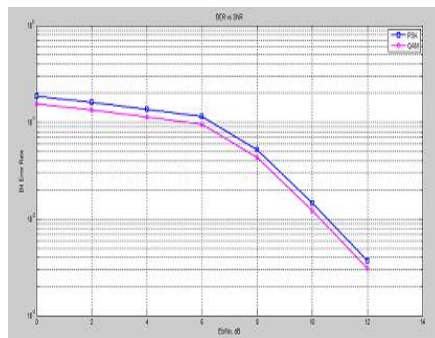
Fig.3 BER visor (PSK)

Fig.4 Comparison plot of BER vs.SNR for QAM and PSK
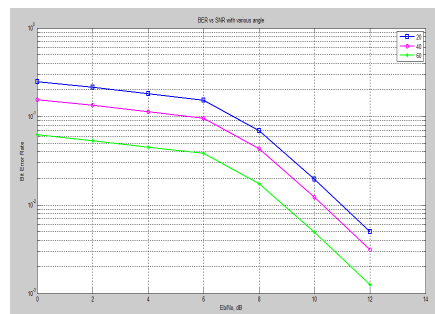
Fig.5BER vs. SNR for Various Angle
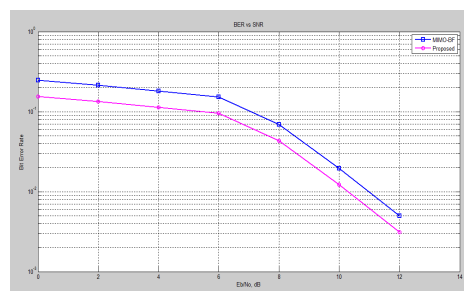
Fig.6 Comparison plot of BER VS SNR for 802.11n Wi-Fi and LTE

V. CONCLUSION

In This Paper we have proposed a new methodology to recognize beam forming technique for MIMO-OFDM in LTE which forms beam at particular angle. Using dynamic beam forming technique for MIMO-OFDM in LTE bit error rate can be reduced. From simulation result we can see that QAM modulation technique is better than PSK because it gives less bit error rate. We conclude to Dynamical beam forming MIMO achieved by combining elements in a phased array in size a way that signals at particular angle experience constructive interference with others experience destructive interference.

REFERENCES

[1]   AlexangraOborina, "Analysis Performance of Mobile MIMO-OFDM wireless Systems Tools & Results".
[2]   Dr.Thamas, L.Stewant "MIMO-OFDM for LTE, WIFI and WIMAX", 2009.
[3]   Massimiliano Ricci, "Beam-Forming and Power Control in Flexible Spectrum Usage for LTE Advanced System", 2008.
[4]   Ratna Singh Taker and Prof. Sneha Jain, "A Review MIMO-OFDM Systems for LTE Environment", ISSN No. (Online): 2277-2626.
[5]   Hanzo, J. Akhtman, M. Jiang, L. Wang MIMO-OFDM for LTE, WIFI and WIMAX Coherent versus Non-Coherent and Cooperative Turbo-Transceivers".
[6]   YounghwanBae, "A Random Beamformingtechnique in MIMO Broadcast Channels".
[7]   Stephen J. Hoelzer, "Design and Simulation of Orthogonal Frequency Division Multiplexing(OFDM) Signaling",May 15, 2001.
[8]   Dirk S. Waldhauser, Leonardo G. Baltar and Josef A. Nossek, "Adaptive Decision Feedback Equalization for Filter Bank Based Multicarrier Systems".