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Performance Improvement of MC-CDMA & CDMA using Smart Antenna Technique

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***Abstract* – Performance improves in terms of coverage in the MC-CDMA & CDMA network with the help of simulation model and an evaluation method for the smart antenna system is presented. The EC/Io coverage area is presented with the proposed method that can show the impact of smart antenna system on the function of antenna type and beam width. The performance improvements are remarkable in the smart antenna systems. Here the data service users as well as the voice services users are considered. The performance of the system is evaluated in terms of Ec/Io Difference. We can observe the throughput with Number of users per sector. Results are discussed based on above parameters for Omni directional antennas air link, orthogonality factor and antenna beam width. It also reduces multipath fading, cochannel interferences, system complexity &cost, BER, and outage probability.**

***Keywords* – Spatial Multiplexing, Multipath Fading, Adaptive Array, Channel Estimation, Throughput, Beamwidth.**

I. Introduction

The recent 3rd generation mobile radio communication systems are proposed to provide high speed multimedia data services as well as voice services, this motivates to reduce interference from other users to increase capacity of mobile radio communication systems the new technique are also used to increase the radio frequency spectrum .The smart antenna techniques are one of those techniques that can achieve these goals. An application of antenna arrays has been suggested in recent years for mobile communication systems to overcome the problem of limited channel bandwidth, thereby satisfying an ever growing demand for a large number of mobiles on communication channels. When an array is appropriately used in mobile communications system, it helps in improving the system performance by increasing channel capacity and spectrum efficiency, extending range coverage, tailoring beam shape, steering multiple beams to track mobiles, and compensating aperture distortion electronically. It also reduces multipath fading, co channel interferences, system complexity & cost, BER and outage probability. It has been argued that adaptive antennas and the algorithms to control them are vital to a high capacity communications system development.

II. Smart Antenna Systems a Need for Smart Antennas

Wireless networks face ever-changing demands on their spectrum and infrastructure resources. Increased minutes of use, capacity-intensive data applications and the steady growth of worldwide wireless subscribers mean carriers will have to find effective ways to accommodate increased wireless traffic in their networks. However, deploying new cell site is not the most economical or efficient means of increasing capacity.

Wireless carriers have begun to explore new ways to maximize the spectral efficiency of their networks and improve their return on investment. Smart antennas have emerged as one of the leading innovations for achieving highly efficient networks that maximize capacity and improve quality and coverage.

III. Problem Statement and Main Contribution

Question that comes to mind is 'How can be performance improved? A Smart Antenna System with the Antennas arrays are used to increased performance in both data services as well as voice. The combination of Alamouti scheme with MIMO maximizes the diversity gain and this in return gives improvement in BER when the numbers of antennas are increased.

IV. Problem Solution

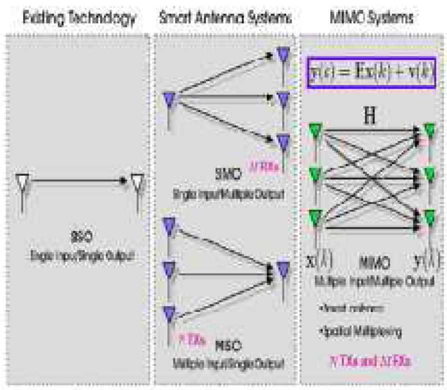

Fig.1. Different systems for wireless communication

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Research Area

- To identify the key obstacles to the development of widely deployed smart antenna systems, and understand the breakthroughs needed to overcome these.
- To identify the areas and applications for which smart antennas will most likely be first deployed.
- To analyse the regulatory issues involved in smart antennas to inform our regulatory instance.

Adaptive antenna technology represents the most advanced smart antenna approach to date. Using a variety of new signal-processing algorithms, the adaptive system takes advantage of ability to effectively locate and track various types of signals to dynamically minimize interference and maximize intended signal reception. Both systems attempt to increase gain according to the location of user; however, only the adaptive system provides optimal gain while simultaneously identifying tracking, and minimizing interfering signals.

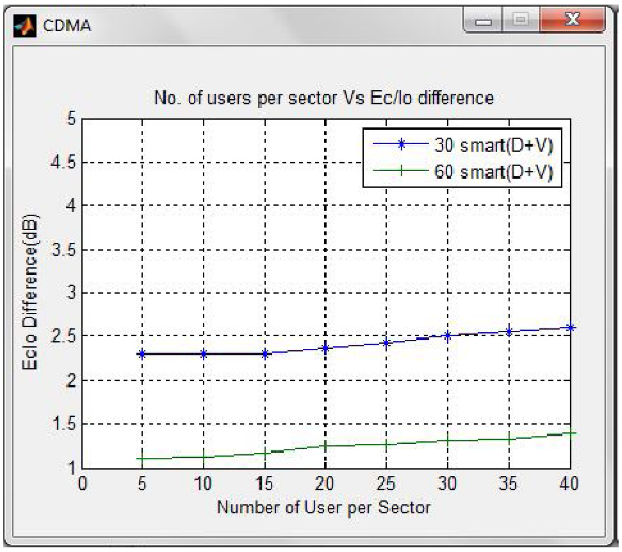
Advantages of Smart Antenna

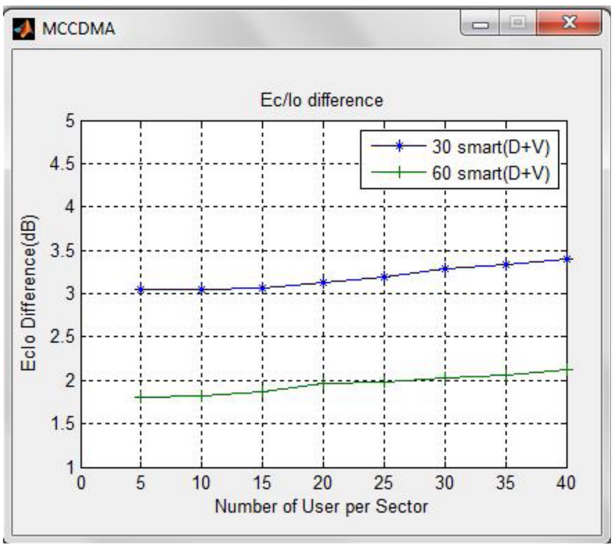
Smart Antenna technology exploits multiple antennas in transmit and receive with associated coding, modulation and signal processing to enhance the performance of wireless systems in terms of capacity, coverage and throughput. A detailed overview of smart antenna systems for use in cellular networks is available in [2]. The CPE can also use multiple antennas in BWA networks. SA techniques can therefore be used for downlink and uplink both at the BTS and CPE. SA leverages (on transmit and receive) include:

- *Array Gain:* Multiple antennas coherently Combine the signal energy improving the carrier to- noise ratio (C/N). Available both on transmit and receive.
- *Diversity Gain:* Spatial diversity obtained from multiple antennas helps combat channel fading. Available on transmit and receive.
- *Interference Suppression Gain:* Multiple Antennas can be adaptively combined to Selectively cancel or avoid interference and pass the desired signal. Available on transmit and receive.
- *Spatial Multiplexing:* Spatial multiplexing uses multiple antennas at both ends to create multiple channels and improves spectrum efficiency (bps/Hz).
- The static simulator developed in this study uses a digitized geographic map as input data. Wave propagation models calculate the path losses by using this map. It is assumed that the whole system area is flat and has an urban type morphology. Here, the one-tier seven macro cell sites configuration is considered to evaluate the performance of the system. Each macro cell site consists of three
- Central cell BS. In this configuration, the other cells around the BS have interference affects on the center cell BS. The distance between each base station is 3.8km and the total transmits 14 power of the ith base station Pitx comes to 41.3 dBm.

The user distribution is assumed to be uniform Within the entire simulation area. The voice and data activities are assumed to be 0.4 and 1, respectively, on the forward lin. It is assumed that the orthogonality factor ais 0.4 and one SCH is used for data service users. It is assumed that the data rate Data requested by a user is 153.6 kbps in this simulation. It is assumed that all users in the system area request the same data rate. Data throughput in this simulation does not include the effects of scheduling. The analysis radius of each base station is set as 7km so that a base station can be affected by the interference from neighboring cells 10, 16. All the results for each mobile position are calculated in its cell area. A mobile position is a bin in the shape of a square and these bins are constructed in the form of a grid covering the entire simulation area.

Ec/Io is calculated for every bin.





V. Conclusion

This paper provides basic information of Smart Antenna system. What will be the effect on Data services & Voice Services if number of antennas is increased on both transmitting and receiving end. Also the work can be extended by using different simulation schemes. The distortion of signal more severely at lower values of SNR (signal to noise ratio). But as SNR is increased the effect of the distortions introduced by the channel will also goes on decreasing, as a result of this the BER will also decreases. In this way large data capacity can be achieved over the existing channels by using higher order modulations, the only thing that should be kept in mind is the extent to which we can increase the values of the SNR. Higher the SNR higher will be the data capacity.

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