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ADAPTIVE BEAM FORMING IN SMART ANTENNA FOR MOBILE COMMUNICATION

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Abstract: **Beamforming the nature of smart antenna which provides improvement on all sorts of wireless communication but still need for study. This paper presents the complete survey of adaptive beamforming strategy for smart antenna. The main goal of this paper is to study the various approach is used for designing the smart antenna and find the issue which is not used in previous work. This paper also proposed a work to solve the sorts in mobile communication with smart antenna.**

Keywords—Adaptive Beamforming, Smart antenna, DoA, BM etc.

I.INTRODUCTION

Smart antennas generally encompass both switched beam and beamformed adaptive systems. Switched beam systems have several available fixed beam patterns. A decision is made as to which beam to access, at any given point in time, based upon the requirements of the system. Beamformed adaptive systems allow the antenna to steer the beam to any direction of interest while simultaneously nulling interfering signals. The smart antenna concept is opposed to the fixed beam "dumb antenna," which does not attempt to adapt its radiation pattern to an ever-changing electromagnetic environment. In the past, smart antennas have alternatively been labeled adaptive arrays or digital beamforming arrays.

This new terminology reflects our penchant for "smart" technologies and more accurately identifies an adaptive array that is controlled by sophisticated signal processing. Figure 1and 2 contrasts two antenna arrays. The first is a traditional, fixed beam array where the mainlobe can be steered, by defining the fixed array weights. However, this configuration is neither smart nor adaptive.

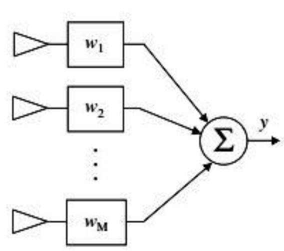

Figure 1: Traditional antenna array

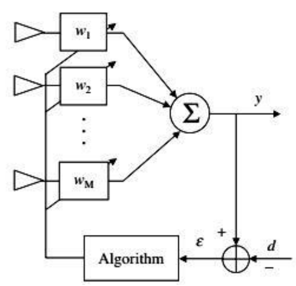

Figure 2: Smart antenna array

II. LITERATURE REVIEW

Wireless communication systems are confined in capacity and performance owing to various deteriorations, such as multipath fading, interference and delay spread. Smart antenna has been suggested for wireless systems to satisfy the demand for increased data rates and the lack of limited channel bandwidth. Switched beam antenna arrays are a subset of smart antennas that can enhance the capacity of a cellular system. Antenna beam switching has been demonstrated as a method of correcting the problem of imbalance across the network cell sites and their capacity. The implementation of Butler matrix (BM) is the key component of a switched beam smart antenna (SBSA).Rotmans lens demonstrated in has a disadvantage of bulky size. An antenna array designed with BM beam forming is used to obtain 4, 8 or 16 different fixed beams at different angles (although increase in the number of beams means increase in size).

Many research works on switched beam antenna have been focused on decreasing the size by reducing the quadrature (branch line coupler) for BM beamforming. Others focused on utilizing RF switches and microcontroller to form a reconfigurable antenna. Application of optimization algorithms, such as particle swarm optimization (PSO) and generic algorithm (GA) in switched beam array have also been demonstrated.

One major challenge which many researchers have been neglecting is how to select these fixed beams of SBSA to maximize its efficiency. SBSA attracted many research interests because of the cost of implementing full adaptive array smart antenna and maximizing its efficiency will encourage the application to the next-generation wireless system. used digital operation to determine which port of BM to turn on, while demonstrated the application of artificial immune system and negative selection algorithm on six sector antenna. Neural networks have been used to solve many engineering problems. A supervised learning algorithm based on the error correction learning rule is modeled and trained to understand the relationship between the position of the target in the coordinate angle and the antenna beam that covers that position. No particular type of signal has been considered as that done in.

III. PROBLEM FORMULATION

The main impediments to high-performance wireless communications are interference from other users (co-channel interference), the inter-symbol interference (ISI) and signal fading caused by multipath. Co- channel interference limits the system capacity, defined as the number of users which can be serviced by the system. However, since the desired signal and co-channel interference typically arrive at the receiver from different directions, smart antennas can exploit these differences to reduce co-channel interference, thereby increasing system capacity. The reflected multipath components of the transmitted signal also arrive at the receiver from different directions, and spatial processing can use these differences to attenuate the multipath, thereby reducing ISI and fading. Since data rate and BER are degraded by these multipath effects, reduction in multipath through spatial processing can lead to higher data rates and better BER performance.

In a cellular system, Omni-directional antennas have traditionally been used at base stations to enhance the coverage area of the base stations but it also leads a gross wastage of power that in-fact is the main cause of co-channel interference at neighboring base stations. The sectoring concept with diversity system exploits space diversity and results in improve reception by counteracting with negative effects of multipath fading. Adaptive / smart 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 its ability to effectively locate and track various types of signals to dynamically minimize interference and maximize intended signal reception. Both adaptive / smart systems attempt to increase gain according to the location of the user; however; only the adaptive system provides optimal gain while simultaneously identifying, tracking, and minimizing interfering signals.

IV. PROPOSED WORK

Smart antenna is an antenna array which uses a number of antenna elements and signal received at each antenna element is adaptively combined to improve the overall performance in mobile communication. Smart antennas can eliminate interference. By producing only radiation beam along the direction of arrival (DoA) of signal, appreciable power saving can be achieved using smart antenna. The smart antenna technology can significantly improve wireless system performance by increasing signal quality, network capacity and coverage area. The digital beam forming method using smart antenna is shown in Figure 3. Signals are processed adaptively in order to exploit the spatial domain of the mobile radio channel. Usually the signals received at the different antennas are multiplied with complex weights and then adaptively weights are summed up. Basically, there are two types of smart antennas, viz., switched beam smart antenna and adaptive smart antenna.

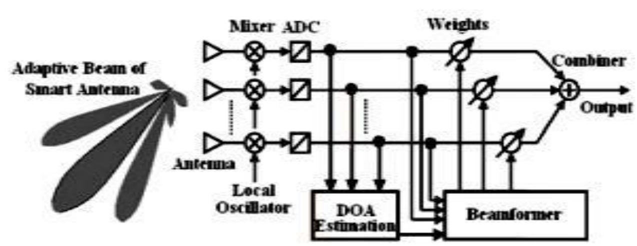

Figure 3: Digital Beamforming Network of a Smart Antenna

In switched beam smart antenna, antenna system has several fixed beam patterns and according to detected condition most appropriate beam is used for communication. Whereas, in adaptive smart antenna, beam can be steered in any direction according to DoA estimation and at the same time null can be generated in the direction of the interferer (Figure.4). Smart antenna estimates direction of arrival of incoming signals and the direction of interfering signals.

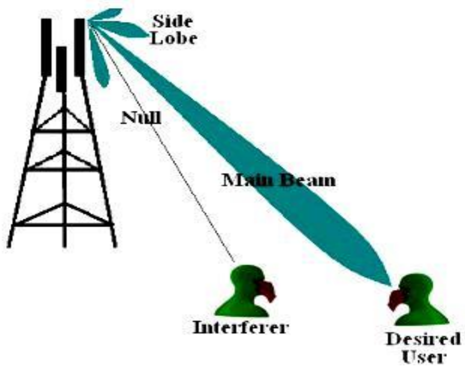

Figure 4: Main Beam towards users and null toward interfere

Then using beamforming algorithm, antenna beam is generated toward the desired direction and null is generated toward the direction of interferer.

V. CONCLUSIONS

This paper is based on the literature survey of the work behind the different type of antenna used in the mobile application. A smart antenna is a very useful for enhancing the capacity of the system. A basic problem is also discussed in this paper. On the problem forming in mobile a proposed methodology is also discussed for enhancing the capacity of the mobile system.

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