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IMPROVEMENT OF SPECTRAL EFFICIENCY AND POWER CONTROL OF SMART ANTENNA

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ABSTRACT

The smart antennas are antenna arrays with smart signal processing algorithms used to identify spatial signal signature such as the direction of arrival (DOA) of the signal, and one of the most important processes is beam forming. In the most important function in beam forming is changing beam pattern of antenna for a particular angle. In the algorithm, a set of position and velocity for angles and amplitudes of antenna currents has been generated to optimized solution in desired direction. The signal gain and interference ratio are compared with genetic algorithm method. The factors that are considered in our method are interference, phase angle and number of patterns.

KEYWORDS: Smart Antenna, Beamforming, Genetic Algorithm, SFIR, SNR, BER, Spectral Efficiency, etc.

INTRODUCTION

The advent of technology and recent developments in communication, wireless communication has reached to new level. Recent updates in wireless communication were not possible without application of smart antennas. Use of smart antennas is one of the vital characteristic that has led to third and fourth generation standard developments. However, smart antenna theory is always driven by the Antenna array and so do the wireless communication. With antenna pattern synthesis there comes speed and robustness to the existing system thereby improvising transmission parameters [3]. Along with this radio wave propagation is a matter of research that accounts to faster and reliable transmission, since wireless is generated from the roots of radio communication. Radio communication was first came into existence in December, 1901 when Guglielmo Marconi successfully received the first transatlantic radio message [1].

In this paper, a GA is used for updating the excitation coefficients of an array. The advantageous of the GA such as fast convergence provided that the GA parameters are appropriately chosen, global optimization, and independently on the eign value spread makes it a practical algorithm for determining the excitation coefficients of smart antenna.

RELATED WORK

Alexander Kuchar, done study in this paper, investigates the increase in spectral efficiency in a cellular mobile communications system employing smart antennas at the base station. We analyze two different strategies Spatial Filtering for Interference Reduction and Space Division Multiple Access and determine the impact of non-ideal power control. The use of SDMA increases the spectral efficiency over SFIR by additional 80%. Furthermore, SDMA adds edibility. Note, however, that the quality of the power control strategy has significant influence on the channel allocation and handover schemes, since a large number of power classes has to be introduced. This would of course decrease the spectral efficiency of the system. Sophisticated power control strategies are, especially for SDMA systems, necessary to keep the system complexity low, and to fully exploit the increase in system performance by smart antennas **[1].**

Mohammed Ali Hussain, the performed a work on the use of smart antennas in ad hoc network. The capacity of ad hoc networks can be severely limited due to interference constraints. One way of using improving the

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overall capacity of ad hoc networks is by the use of smart antennas. Smart antennas allow the energy to be transmitted or received in a particular direction as opposed to disseminating energy in all directions. This helps in achieving significant spatial re-use and thereby increasing the capacity of the network **[2].**

K. Meena alias Jeyanthi, in this paper worked on adaptive algorithm with interference suppression. In this Modeling and simulation of uniform linear array using Matrix Inversion Normalized Least Mean Square (MI-NLMS) adaptive beam forming with minimum Bit Error Rate (BER) is developed for smart antenna applications. The algorithm have the advantage of both block adaptation and sample by sample techniques which shows that the performance of block adaptation and normalization of Least Mean Square (LMS) improves the system capacity and minimize bit error rate (BER) upto 10-4 for the signal to noise ratio of 13 dB's. The Quadrature amplitude modulation (QAM) allows us to send more bits per symbol to achieve higher throughput and to overcome fading and other interferences. The simulation is done in MATLAB. Adaptive beamforming allows several attractive features **[3].**

SMART ANTENNA

Smart antenna consists of an antenna array, combined with signal processing in both space and times. It overcomes the problem of limited channel bandwidth, and satisfying a growing demand for a large number of mobiles on communications channels. A Smart antenna help in improving the system performance by increasing channel capacity and spectrum efficiency, steering multiple beams to track many mobiles, compensating electronically for aperture distortion, extending range coverage. To steer the main beam, according to the direction of arrival of desired signal, in adaptive beam forming is control by the values of weight vector. It finds the optimum values of these weight vectors adaptive algorithms are used. These use beamforming algorithms to identify spatial signal signature and is used to compute beamforming vectors to track the antenna beam on receiver? Smart antennas enhance system performance, coverage and spectrum efficiency, channel capacity. Smart antennas use efficient methods to track multiple users and reduce interferences.

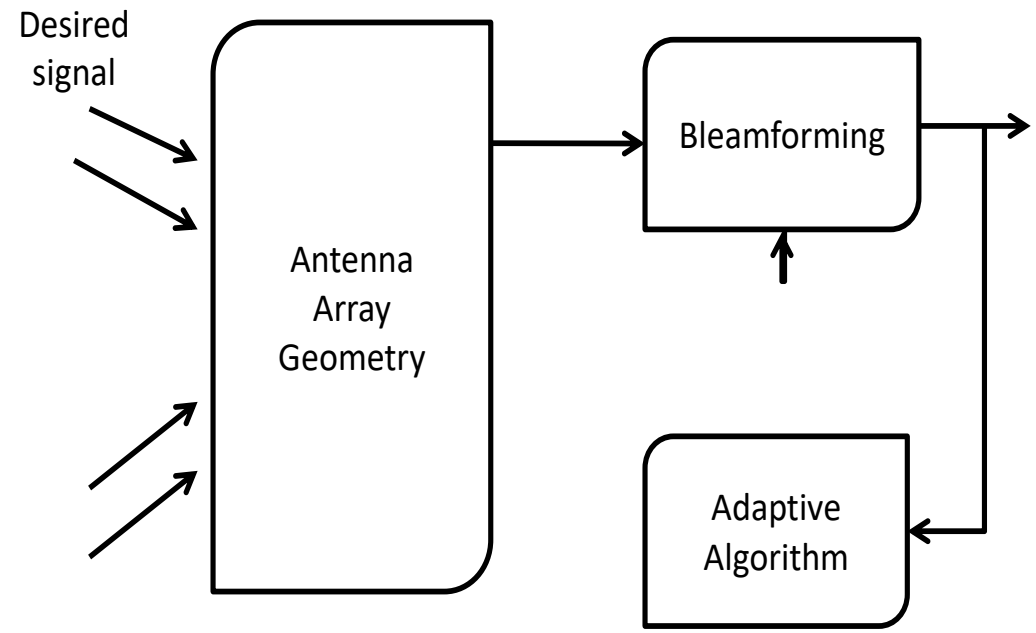

Fig: 1 Block diagram of Smart antenna system

The smart antenna radiation pattern nullifies the interference (unwanted) signal angle of arrival and direct the beam towards the desired (wanted) signal angle of arrival, by this the capacity of the system is improved and this process also leads to maximize the Signal to Interference Ratio, indeed maximizes the throughput of the network.

Functions of Smart Antenna System

The smart antenna consists of mainly two functions.

- Direction of arrival (DOA) estimation

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- Beam forming

The smart antenna system estimates the direction of arrival of the Signal (DOA).

GENETIC ALGORITHM METHOD

Genetic algorithm is an iterative stochastic optimizer that works on the concept of the survival of the fittest, motivated by Darwin, and uses methods based on the principle of natural genetics and natural selection to construct search and optimization procedures that best satisfies a predefined goal. Genetic algorithms search about the solution space of a function through the use of simulated evolution, i.e., the Survival of the fittest strategy. In general, the fittest individuals of any population who tend to reproduce and survive to the next generation, so improving a successive generation. However, inferior individuals can, by chance, survive and also reproduce. Genetic algorithm has been show to solve linear and nonlinear problem by exploring all regions of the state space exponentially exploiting promising areas through mutation, crossover, and selection operation applied to individuals in the population. Genetic algorithms use principles of natural evolution. And there are five important features of (GA) as follow:

The important parameters of GA are:

Selection –this is based on the fitness criterion to choose which chromosome from a population will go on to reproduce.

Reproduction –The propagation of individuals from one generation to the next.

Crossover –This operator exchanges genetic material which is the features of an optimization problem. Single point cross over is used here.

Mutation –The modification of chromosomes for single individuals. Mutation does not permit the algorithm to get stuck at local minimum.

Stopping criteria – The iteration stops when the maximum number of cycles is reached. The grand minimum CF and its corresponding chromosome string or the desired solution are finally obtained.

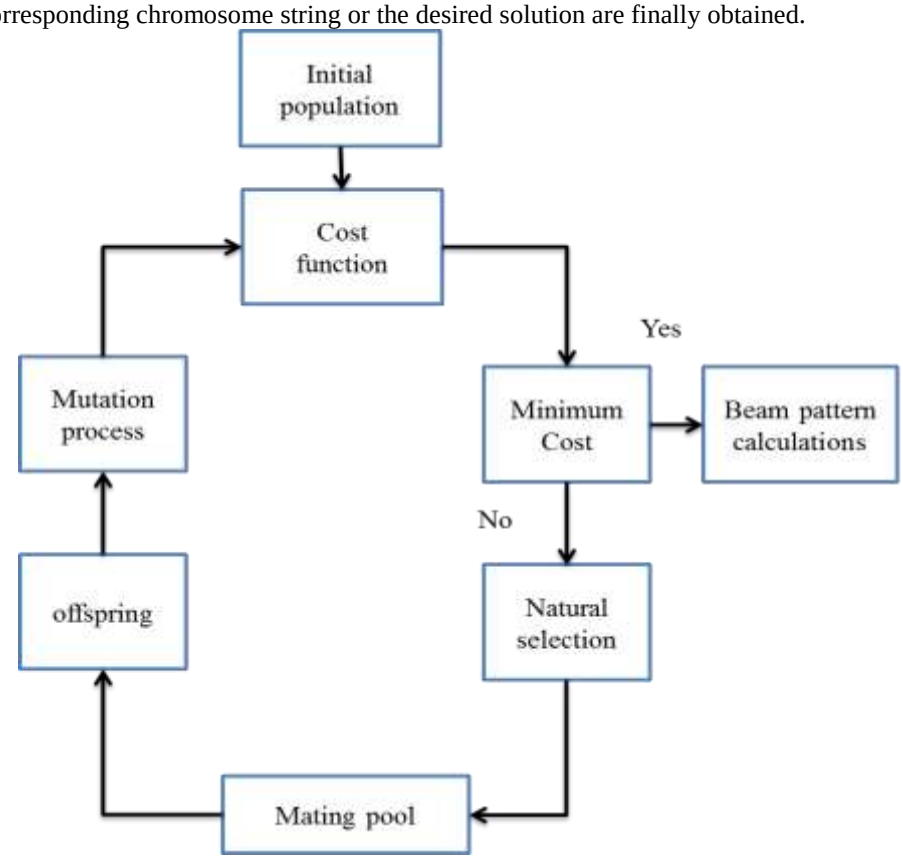

Fig: 2 Flowchart of Genetic Algorithm

RESULTS AND DISCUSSION

The proposed technique was implemented in Mat lab. In the proposed method if we give the angle as input to

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the system it gives the corresponding beam as output. Here, first we give one angle as input to the system and the corresponding beam obtained is analyzed and for that beam the interference ratio and gain are calculated. The results are finally compared with that of the Genetic Algorithm (GA) technique. Then the number of angles is increased and again the same process is repeated.

Table: 1 Performance of Simulator parameter

S. No.	Parameter	Description
1	FFT	64
2	No. of Symbol	50
3	OFDM Symbol	52
4	No. data Subcarriers	52
2	Modulation	QPSK
3	Optimization Method	GA
4	SNR	0:2:25

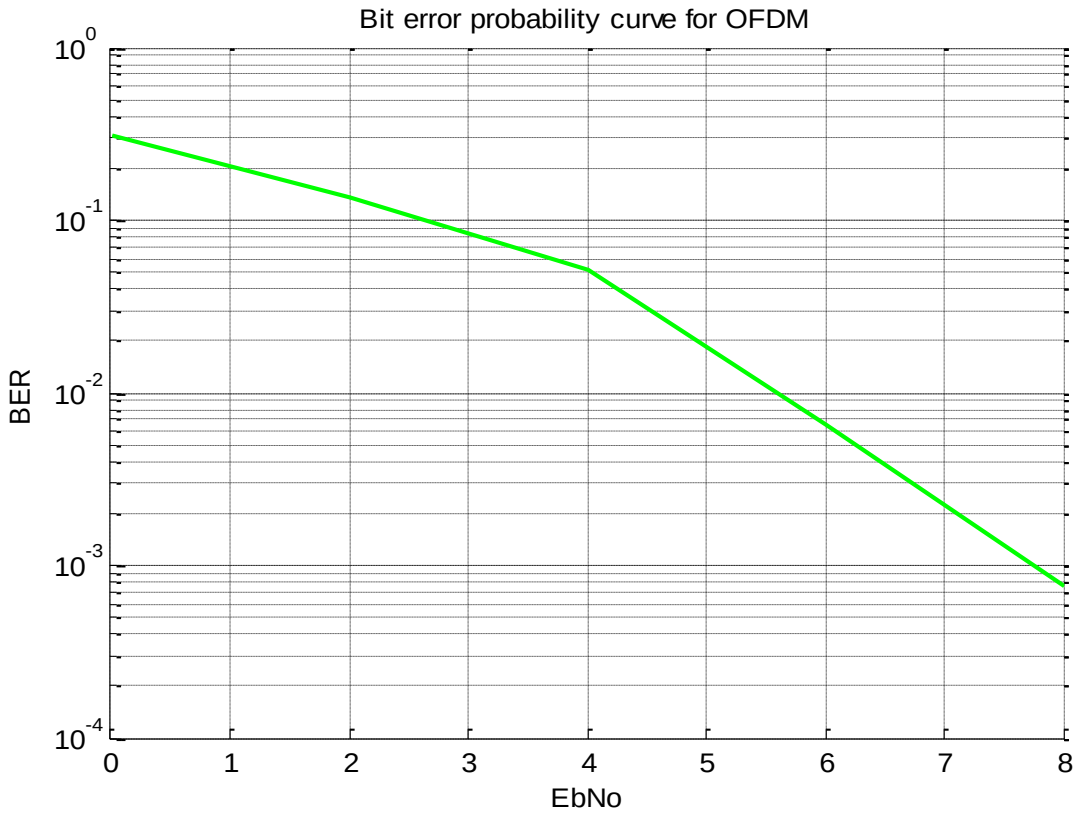

Fig: 3 Performance of SNR Vs Bit Error Ratio (BER)

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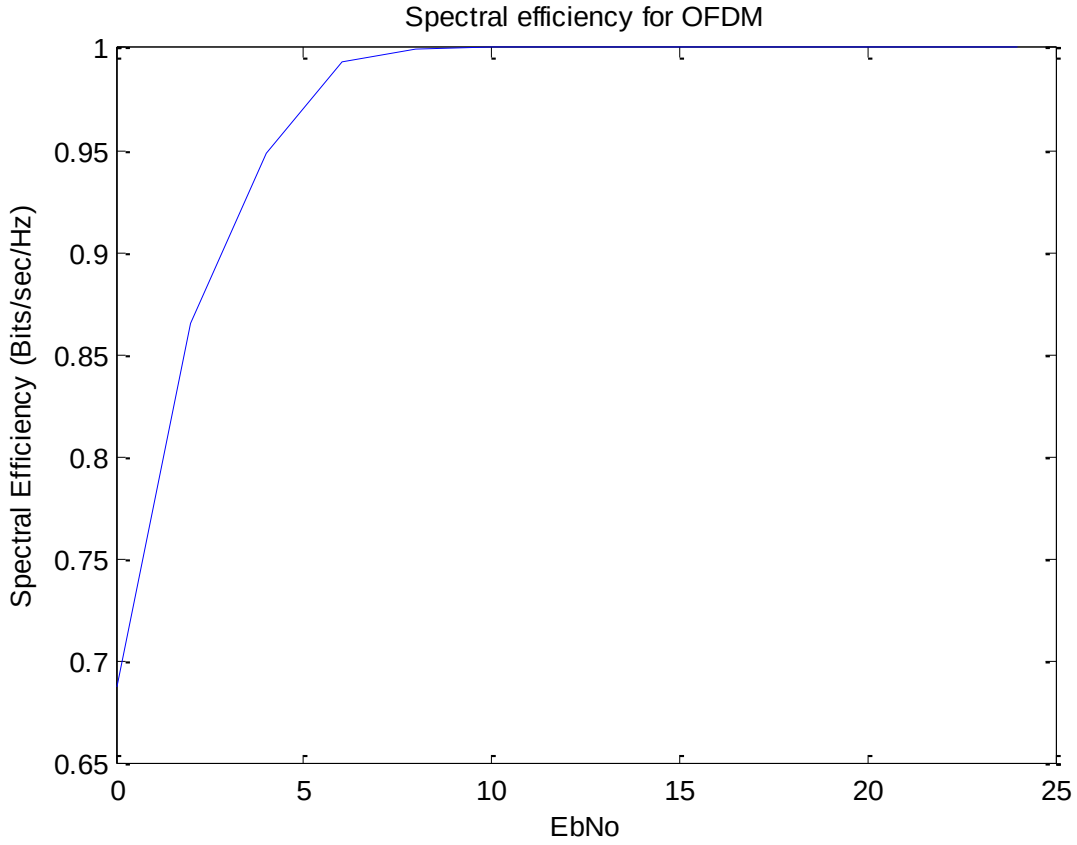

Fig: 4 Performance of SNR Vs Spectral Efficiency (Bit per sec/ Hz)

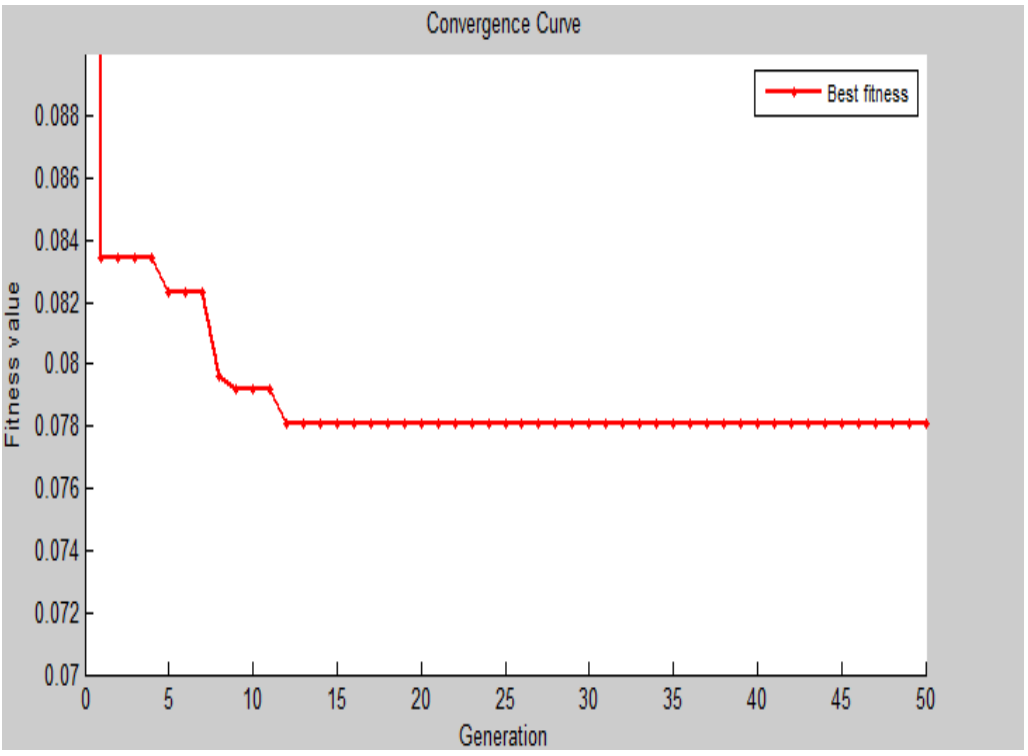

Fig: 5 Performance of Genetic Algorithm (Generation Vs Fitness)

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CONCLUSION

In this paper Genetic Algorithm is used to locate the beam pattern with maximum signal gain for given angle in smart antenna. Using this technique reduced side lobe and moved angle array direction.

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