PERFORMANCE EVALUATION OF SPACE TIME TRELLIS CODED MIMO FOR MOBILE COMMUNICATIONS

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ABSTRACT

The major enemy of wireless communication is multipath fading that highly degrades the received signal. Spatial diversity highly reduces deep fades of the wireless communication. Higher signal to noise ratio (SNR) requirement can be reduced by using space time coding. In this paper, the error performance of un-coded MIMO, different diversity combing methods, space time block codes and space time trellis codes are analyzed using different parameters including number of antennas, M-array modulations, trace criteria, rank and determinant. The simulation results have shown that the Bit Error Rate (BER) significantly reduces with increasing number of receiver antennas. However, the number of antennas that a mobile device can have is limited by its size and this is inconvenient for mobile communication. Hence, this paper suggests space time codes to mitigate multipath problems in mobile communication. So, BER performance of space time block codes scheme was evaluated by varying the number of transmitter and receiver antennas along with varying M-array PSK modulation orders. The results have shown that better BER is possible by integrating space time codes with spatial diversity. Finally, the error performance of space time trellis codes was evaluated by using trace, rank and determinant, and the simulation results depicted that better error performance is achieved using the proposed multipath reduction method.

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INTRODUCTION

There have been many applications present in our day to day lives that have the involvement of cellular communication. The applications such as Internet, money transaction services, sending messages and using cell phones as communications through callings are the common activities involved. However, there are also many limitations within these systems in comparison to the wired mediums. The properties that wired mediums have involve the open access, limited transmission capacity as well as the systems complexity. There is a question here about the wireless network's security characteristics like authentication integrity and secrecy. There is a packet switched code connected to the external networks within the 3G networks that helps these networks to be prevented from various types of attacks that can destroy the privacy of the networks.

In the late 1990s, cellular networks were put into operation. There is an increment of applications within these cellular networks. There is no encryption in First Generation networks because of the analogue nature of these networks, which also feature poor sound quality and inefficient spectrum usage [1]. Second-generation (2G) cellular networks introduced the concept of digital modulation. Personal communication services are another name for them. In this method, the voice was converted into digital code which was further converted into analog signals. This technology helped in eliminating many limitations of 1G system. Code Division Multiple Access (CDMA), North American Time Division Multiple Access (NA-TDMA), Global System for Mobile Communication (GSM), digital AMPS (D- AMPS), and Personal Digital Cellular are just a few of the 2G technologies that have been implemented (PDC). 2G network were however utilized only for voice communications within the networks. Between the 2G and 3G networks, the 2.5G networks were developed which werealso known as the data services that are extended to 2G. As the global standard these days the third generation (3G) standard is being utilized within various applications within the cellular communications. The various services such as internet browsing, monetary services and so on can be provided through this system. Here, CDMA2000, Wideband CDMA (W-CDMA), and Time Division-Synchronous Code Division Multiple Accesses are the three primary technologies used (TD-SCDMA). However, even with the utilization of 3G services, the evolvement of 4G has been seen within these technologies. The data rates up to 20 Mbps are to be designed in this generation. The support of cutting edge is provided for ensuring minimum cost for system and higher capability of supporting communication amongst the mobile vehicles

Cellular Concept in Mobile Communications

The distance between the locations isn't the primary factor in the discovery of interference effects. For estimating the ratio of distance between the places for transmitting electricity, however, this is a very crucial issue to consider. The number of potential customers can be increased by the service providers through the minimization of radius up to around 50%. There would be around 100 times of increment of channels as compared to the systems around the areas of 10 kilometers in radius within the systems that have around one-kilometer radius. A few hundred metres in radius may be reduced to a few hundred metres when there are a large number of calls available in the network. With respect to the density of thesubscriber as well as the requirement of the provided region, there have been introduced low- power levels which help in designing the cell within this cellular technology. With the growth in the demand, there can be more cells added within the network. There can be a reutilization of the frequencies that are involved as a part of one cell cluster. During the mobility of users between the cells, the conversations can be transferred from one cell to another. The communication of radio devices with the mobiles can carry on till they are within the range of each other. When the mobile goes out of the range of radio devices, the energy of the range fades away. With the help of channels, the base station and mobiles communicate with each other as done in earlier technologies. There are two frequencies involved within the construction of a channel amongst which the one is utilized for transmitting information towards the base station. The second is further utilized for receiving the information from the base station end.

THE GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

The Base Station Subsystem (BSS), the Network and Switching Subsystem (NSS), and the Operation and Maintenance Subsystem (OMS) are all parts of the GSM technology (OSS). It has Base Transceiver Stations (BTS), as well as Base Station Controller (BSC). The BSS generates and manages the transmission routes as well. Mobile Switching Centers (MSC) and Mobile Stations (MS) are also included in the architecture of NSS. The exchanging and the various arrangement functions present within the networks are also mainly present within the NSS. The Home Location Register (HLR) and Visitor Location Register (VLR) functions constitute the GSN area management database.

In order to interface the external networks, the NSS can as well be applied. The functions that are needed for network management communication are provided by the OSS for providing facilities to the objects

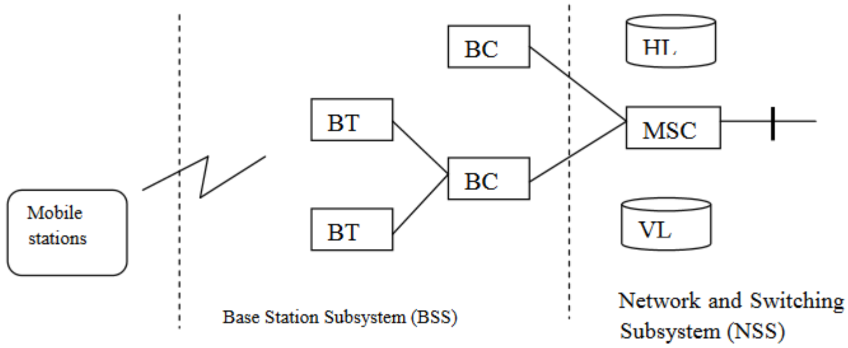

Figure 1: General Architecture of a GSM Network

PROPOSED SYSTEM

Increased bandwidth and reduced bit error rate are expected with the new technology (BER). OFDM is the most frequent method for transmitting high-speed data across long distances. At the transmitter or receiver, OFDM may be used with antenna arrays to improve reception of time-varying or frequency-selective channels and enable MIMO. For the LTE-A structure to be predictable, an algorithm is developed. Use MATLAB's long-distance bandwidth or universal mountain top data rates to prepare for better design. Our long-term goal is to implement enormous MIMO.

The planned LTE-A has a greater data rate than the current version of LTE-A. Broadcast bandwidth can only be increased by using higher data rates. Data rates of this magnitude are the ultimate objective. Some operators and/or time-channel aggregation are being misused. Using the LTE-A carrier, the common transmission bandwidth owner may take use of these additional extensions. The downlink flow is altered by this new method. His study focuses on the 3GPP standard's version 10 and examines the performance analysis of Turbo coded MIMO-OFDM in LTE-A networks employing 64-QAM modulation and 256 subcarriers. By simulating 16x16 and 8x8 MIMO downlink systems in MATLAB, we can determine the bit error rate (BER) and throughput in terms of signal-to-noise ratio (SNR).

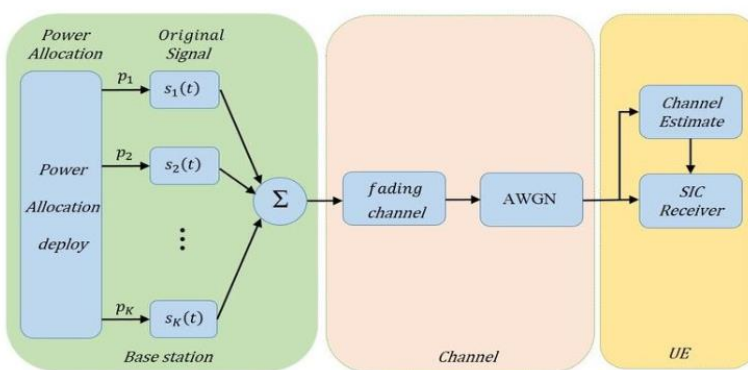

Figure 2 : Architecture Diagram

Rayleigh Channel (Non-LOS), Rician Channel (LOS) and AWGN Model Different forms of fading occur in multipath systems, ranging from large-scale fading to small-scale fading. While in the large-scale fading attenuation of the received signal power is defined by the route profile's geometry, in smaller fading the received signal power fluctuates rapidly due to signal attenuation, which is governed by the path profile's geometry. In flat fading, the bandwidth of the mobile channel is clearly bigger than the bandwidth of the sent channel, or all frequency components of a received radio signal fluctuate in the same proportion simultaneously.

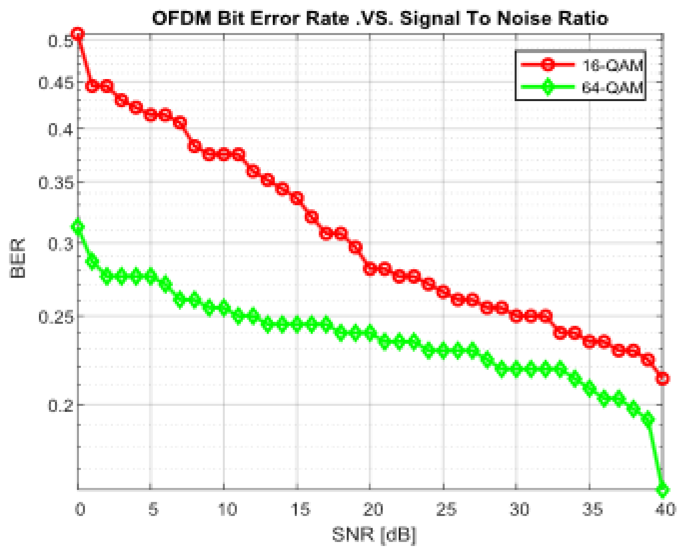

Figure 3 : OFDM Bit Error Rate vs. Single to Noise Ratio

Figure 3, represents different line curve for different modulation as per legend. QPSK modulation scheme gives BER at 40 dB SNR and 16 QAM and 64 QAM modulation techniques

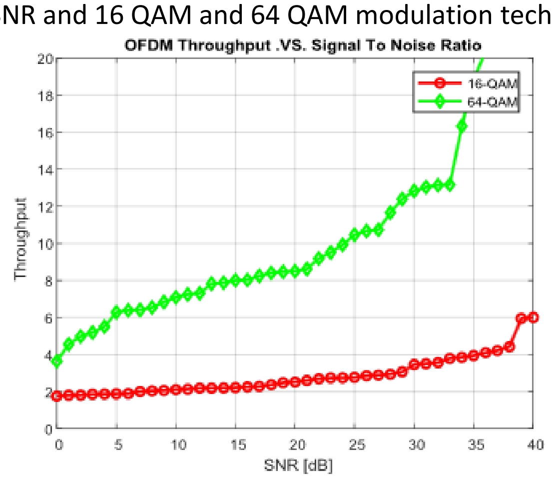

Figure 4 : OFDM Throughput vs. Signal to Noise Ratio

Figure 4 represents different line curve for different modulation as per legend. QPSK modulation scheme gives Throughput at 40 dB SNR and 16 QAM and 64 QAM modulation techniques.

Table 1: Result Comparison

Modulation technique	SNR	BER	Throughput ((bps)
16 QAM	40dB	0.5	2
64 QAM	40dB	0.32	4

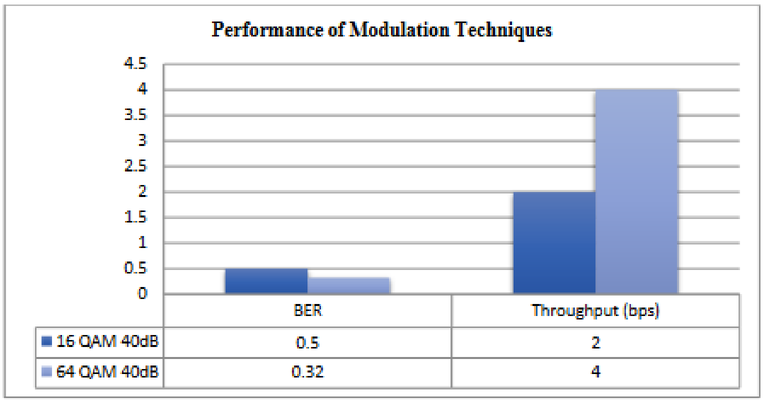

Figure 5 : Performance of the Modulation Techniques

LTE-A simulations are carried out using the parameters in table 2 to evaluate the proposed 16 x 16 MIMO and 8 x 8 MIMO systems. There are N=256 subcarriers in the 64-QAM input samples in the AWGN channel. BER and Downlink throughput are used to evaluate the system's performance. Rate of Bit Errors The bit error rate (BER) is determined by the amount of incorrect bits in a sample. In order to distinguish between them, the total number of substituted bits is added together and then separated by a thought-about interim time.

CONCLUSION

3G networks include a packet-switching algorithm that shields them against a variety of assaults that might compromise the privacy of these networks. There is a different temporary radio channel present for communicating with different cell site for each mobile. Over some distance the radio frequency fades and so it is necessary for the mobiles to stay close to the base station in order to continue the communication with other mobiles. There are telephone systems and radio services present within the mobile networks. Within the closed network the mobile radio services are also present which operate within a closed network. In this work, it is been concluded that efficient resource reservation leads to easy handoff in the cellular networks. The efficient priority based technique is proposed in this work which assigns priority to the users according to data usage of the host. The user which sends more time in the network has least priority and vice-versa. The proposed technique is simulated in MATLAB and it is been analyzed that resources sharing is done in the more efficient manner as compared to existing technique.

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