Space-Time Coded OFDM for High Data rate Wireless Communication over Wideband Channels

[1]Sana, [2]Ravinder Kumar
[1]Research Scholar, [2]Lecturer
[1,2]Department of Electronics and Communication Engineering, Al-Falah,University,Dhauj ,Faridabad

Abstract- **Assume a STC (space-time codes) OFDM (orthogonal frequency-division multiplexing) scheme the receiver antennas and multiple transmitters on compared time-chosen fading channels and frequency. It has been displayed that the time-selectivity product array is the input parameter to describe the associated fading channel outage capacity. It is considered that space-time codes with huge efficient extents and perfect fixed inter-leaver are very in abusing the natural variety in multiple- antenna associated fading channels. The recommend a LDPC (low-density party-check) STC-OFDM of code based scheme. Evaluated with the usual STTC (space-time trellis code), Base on the LDPC significantly increases STC the performance of the system by abusing diversity of selective fading and spatial diversity in wireless channel. Evaluated with the current offered STC system of turbo-code-based based on LDPC STC displays complexity of lower receiver and very flexible extendibility. Propose receiver plan for STC-OFDM of based on LDPC schemes in unidentified fast fading channels and offer a receiver of novel turbo using demodulator of MAP-EM (maximum a posteriori expectation-maximization) and soft decoder LDPC that will extensively decrease the error level in fast fading channels by the complexity of modest computation. With that turbo receiver, the offered STC-OFDM of LDPC-based scheme is a assuring result to more capable data transmission on the wireless channels of selective fading mobile.**

***Key words*–** **OFDM (Orthogonal frequency-division multiplexing),STC (space-time codes),STTC(space-time trellis code)**

I. INTRODUCTION

Currently there is enhancing interest in granting services of high data-rate like internet access of multimedia , video conference, and WAN on wireless channel of wide-band, it is presented in PCS band have been imagined to be applied by the units of high Doppler (mobile) and low Doppler (stationary) in a diversity of delay extend reports. Which is the competitive task, provided the limited connection budget and wireless environment severity, and for novel forceful bandwidth efficient methods the calls that effort consistently at low SNRs.

Finally, plan an OFDM (orthogonal frequency division multiplexing) of space time code, adapted physical layer. This joins modulation and coding. Recently, recommended the space-time codes for wireless channels of narrowband. These codes contains high spectral effectiveness and very less SNR functioning.Alternatively, for wideband channels OFDM has established as a system of modulation.

Joins these in a natural way and plan a scheme attaining 1.5-3 Mbps data rates. On a bandwidth channel of 1 M Hz. this scheme needs 18-23 dB accept SNR at 10^{-2} probability of frame error with one receive antennas and two transmit. Since space-time coding could not need any interleaving form, the recommended system is smart for the applications of delay-sensitive.

II. PROBLEM DEFINITION

Wireless communications across the wideband channels are being used widely for transmitting high end applications like video conferencing, multimedia applications and wide area network file transfers. There are some limitations across these implementations and they are mainly because of the limited channel capacity and the complexity of wireless communication environments.

These limitations affect the bandwidth efficiency and of the network and to increase the bandwidth efficiency, I would like propose a technique based on Space time coded OFDM system. A modulated physical layer is constructed across the Space-time coded OFDM system and this can be used to achieve reliable communication even in case of low SNR. Different forms of interleaving can be eliminated with the help of Space-Time coding and this coding can also a best choice for delay sensitive applications like video conferencing. A multiple antenna wireless communication system is considered to proceed with the development of the proposed system.

III. AIMS AND OBJECTIVES

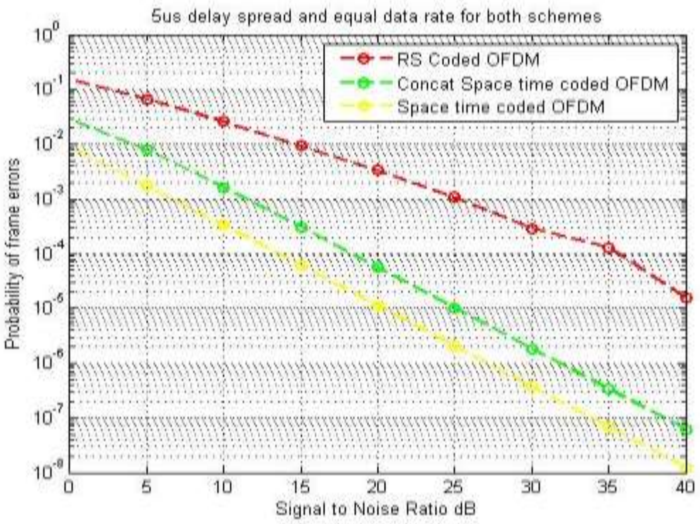
AIMS: To simulate the high data rate wireless communication across wide-band channels with the implementation of Space-Time coded OFDM.

Objectives: Following are the research objectives of the project

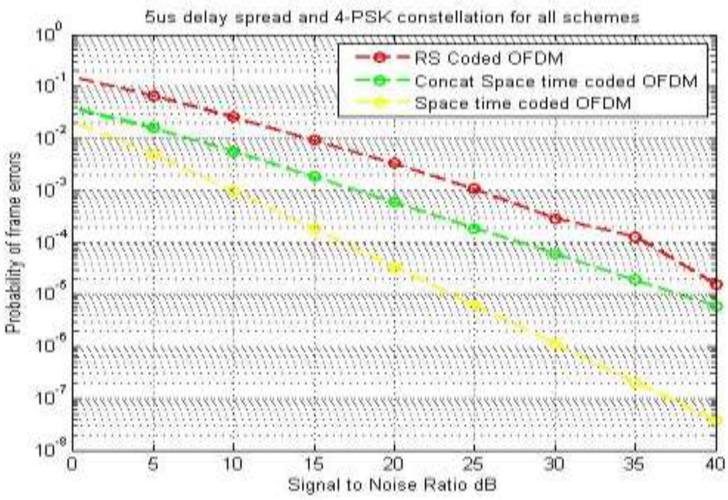
- To understand the concept of data rate and its importance across wideband channels of OFDM and the current limitations.
- To prepare literature review on the existing problems affecting the performance of data rate across wireless communications and the limitations.
- To design a Space-Time coded OFDM that promise high data rate services across wideband channels.

- To simulate the proposed system in MATLAB and document the observation.

IV. Simulation and Result -:As can be seen in figure (a) the channel's frequency selectivity is exploited and its performance increases importantly in presence of multipaths through the help of RS coded OFDM scheme. Even for this favorable delay spread of 5μs, the gap of SNR among space-time codedOFDM scheme and RS coded OFDM scheme is significantly 3dB as shown in the figure (a)



fig(a)-: 5us delay spread and equal data rate for both schemes



fig(b)-:5 us delay spread and 4-psk constellation for all schemes

In this figure (b), the delay at 5μs is not just right to cause major correlation between the RS symbol's signal strengths in a code word and to offer frequency selectivity. 6dB less SNR is required by the RS coded OFDM scheme even though it is transmitted at only half data rate. It can also be observes that the performance of RS coded scheme enhances moderately because of availability of frequency selectivity in the channel. At this delay spread this scheme performs much better when compared to space-time coded OFDM scheme by 6dB.

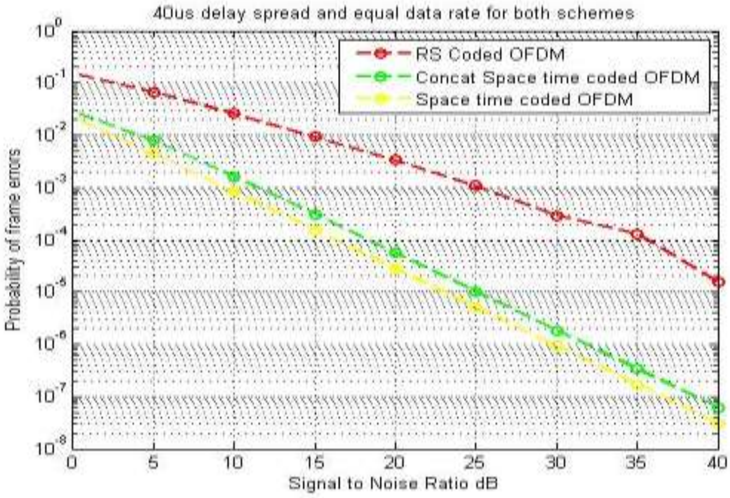
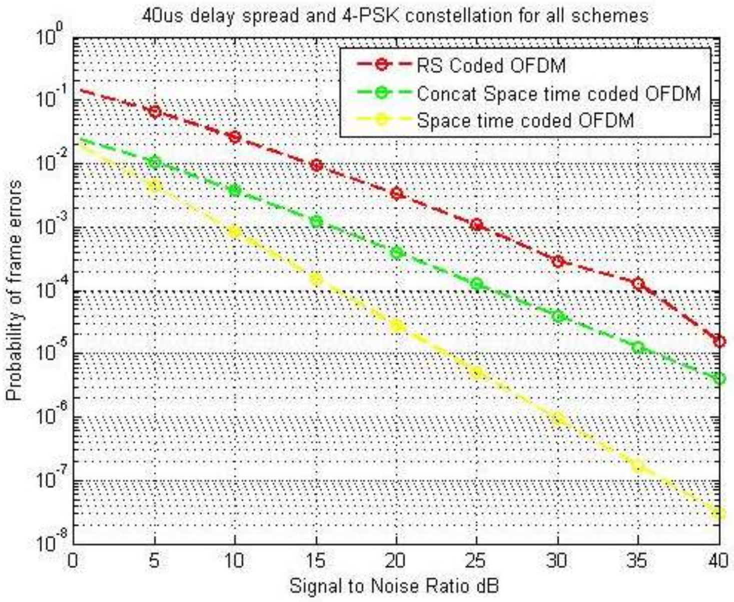


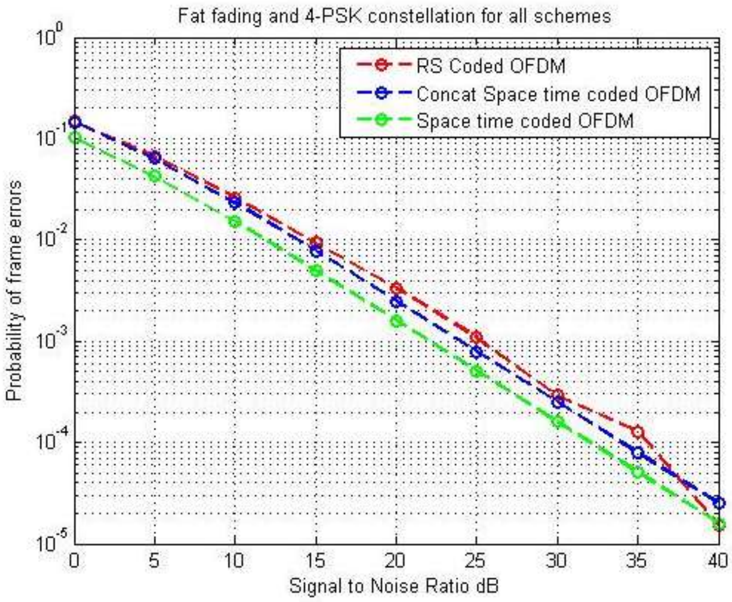
fig (c)-:40 us delay spread and equal data rate for both schemes

As can be seen in figure(c), at delay spread of 40µs, significant correlation present between the RS symbol's signal strength minimizes the diversity gin being offered by RS coded OFDM scheme. By causing the SNR gap among two schemes in order to go up to 7 dB, the performance of space-time coded OFDM scheme is maintained by itself. Therefore, the space-time coded OFDM scheme for the purpose of equal data rates will outperform S coded OFDM scheme all the time. The decrease in desired signal to noise ratio (SNR) will depend on the channel's frequency selectivity

As can be seen in this figure (d), significant correlation will be caused by a delay spread of 40µs among the RS symbol's signal strength in a code word and the gain of diversity will be reduced being offered by RS code. The diversity of space-time coded scheme is maintained, by this scheme itself as well as is performed in relation with RS coded OFDM scheme at twice data rate. The scheme outperforms RS coded OFDM scheme by 2dB through the use of the outer code, while consisting of bandwidth efficiency of more than 1.75 times.



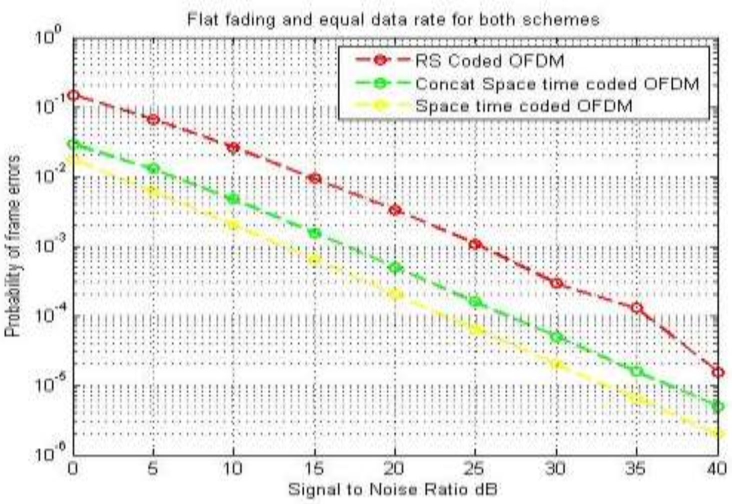
Fig(d)-:40 us delay spread and 4-psk constellation for all schemes



Fig(e)-:flat fading and 4-psk constellation for all schemes

In this figure (e) the performances of various schemes have been represented in fat fading environment. This result is for one transmit antenna and one receive antenna. RS coded OFDM scheme will depend on channel's frequency selectivity in order to gain diversity, even though diversity is being generated by the space-time coded OFDM scheme despite of frequency selectivity. RS coded OFDM scheme is outperformed by the space-time coded OFDM scheme by 6dB in spite of including twice the efficiency of bandwidth. If the path gain in flat fading environment is small in magnitude, then each tone broadcasted will include very small signal strength in this antenna. Thus, a large symbols fraction being transmitted will be in error after symbol-by-symbol decisions are made. However, in such situation this scheme performs well as the space time codes are developed in order to offer diversity despite of channel's frequency selectivity.

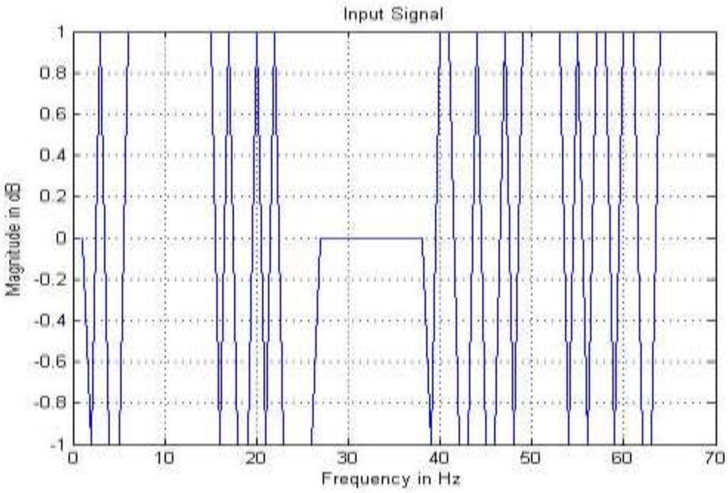
In this figure (f), the delay at 5µs is not just right to cause major correlation between the RS symbol's signal strengths in a code word and to offer frequency selectivity. 6dB less SNR is required by the RS coded OFDM scheme even though it is transmitted at only half data rate. It can also be observes that the performance of RS coded scheme enhances moderately because of availability of frequency selectivity in the channel. At this delay spread this scheme performs much better when compared to space-time coded by OFDM scheme.



fig(f)-:flat fading and equal data rate for both scheme.

In figure (g) represents the input signal of the ifft transform for the orthogonal frequency divisional multiplexing channel generation. The remaining figures explaining about the OFDM signal generation in the time domain and the performance of the space time coding in the phase shift keying constellation for all schemes in different time delays time spreading.

The performance is shown in between the probability of the frame errors and the signal to noise ratio for RS code, concat space time and space time coded OFDM

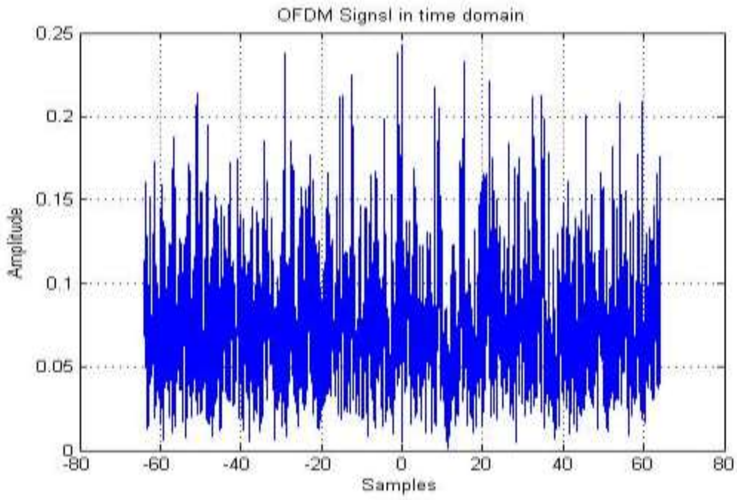


Fig(g)-:input signal of the ifft transform

This figure (g) represents the input signal of the ifft transform for the orthogonal frequency divisional multiplexing channel generation. The remaining figures explaining about the OFDM signal generation in the time domain and the performance of the space time coding in the phase shift keying constellation for all schemes in different time delays time spreading.

The performance is shown in between the probability of the frame errors and the signal to noise ratio for RS code, concat space time and space time coded OFDM.

As can be seen in the figure (h), the OFDM signals in time domain are given where the amplitude of all the positive as well as negative samples increases equally



Fig(h)-:OFDM signal in time domain

V. Conclusions

In this paper, we described space-time coded OFDM scheme for providing high data rate wireless communication over wideband channels. We showed that proposed scheme is capable of reliable transmission at relatively low SNRs in a variety of delay profiles making it a best alternative.

VI. References

[1] .L.J.Cimini and N.R. Sollenberger,OFDM with diversity and coding for high-bit rate mobile data applications AT and T Technical Memorandum HA6131000-961015-07TM.
[2] .J.A.C.Bingham,Multicarrier modulation for data transmission:an idea whose time has come,IEEE Trans on commun…,vol 2P,No.5,May 1990,pp5-14.
[3] E.A.Lee and Messerschmitt,Digitalcommunication,Kluwer Academic Publishers,Boston 1994.
[4] D.Aggarwal,V.TarokhandN.Shshadri Space-time coded OFDM for high data-rate wireless communication over wideband channels,in preparation.
[5] W.C.Jakes,Micrawave mobile communications,IEEE press,Piscataway,1993.