Performance Analysis of V-Blast Spatial Multiplexing with Ml and MMSE Equalisation Techniques using Psk Modulation

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ABSTRACT

Now a day wireless technologies face the challenges of multipath signal fading, attenuation and phase delay which led to the interference between users and there is the possibility of limited spectrum. Linear and Non-Linear receiver is used to combat the effect of multipath signal fading and delay. The wireless communication system employs the application of multiple antennas at both transmitter and receiver to improve data rates through multiplexing techniques. In this paper, we analysis of V-BLAST spatial multiplexing technique with equalisation techniques like ML, MMSE with PSK techniques in communication channel Rayleigh flat fading. The simulation results find out through the Mat lab R2013a Simulink block.

KEYWORD: *BER, Communication channel, Equalizer, Modulation, SNR, V-Blast.*

I.   INTRODUCTION

Telecommunication systems are generally designed by telecommunication engineers which sprang from technological improvements in the telegraph industry in the late 19th century and the radio and the telephone industries in the early 20th century. Today, telecommunication is widespread and devices that assist the process, such as the television, radio and telephone, are common in many parts of the world. There are also many networks that connect these devices, including computer networks, public switched telephone network (PSTN), radio networks, and television networks. Computer communication across the Internet is one of many examples of telecommunication.

The wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. Wireless communication is reliable, robust and secure. It is suitable for indoor and outdoor use under extremely harsh conditions. Wireless solutions offer far more benefits than just the elimination of cabling and installation costs. Users also profit from significantly faster commissioning and more efficient maintenance, as well greater flexibility and mobility. And wireless technology ensures improvement of production quality and safety in plants. In the end, all of these advantages add up to greater overall plant availability.
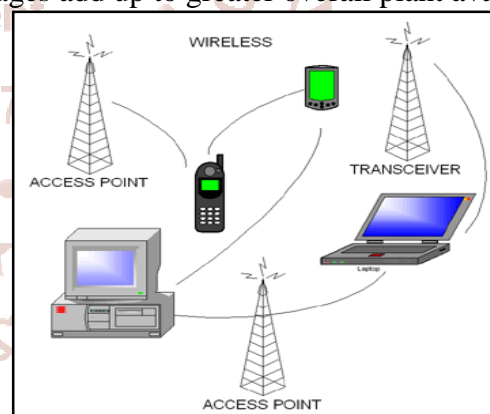

Fig.1: Wireless Technology

II.   Vertical-Bell Laboratories Layered Space-Time

V-BLAST is detection Algorithm to the receipt of multi-antenna MIMO systems, Available for, first time in 1996 at Bell Laboratories in New Jersey by Gerard J. Foschini, He proceeded simply to eliminate interference caused Successively issuers, spatial multiplexing is transmission technique in MIMO

wireless communication to transmit independent and separately encoded data signals. Therefore, the space dimension is reused, more than one time. V-BLAST is one of the better techniques of spatial multiplexing. Although-BLAST is essentially a single-user system which uses multiple transmitters, one can Naturally ask in what ways the BLAST approach differs from simply using traditional Multiple access techniques in a single-user fashion i.e. by driving all the transmitters from A single user's data which has been split into sub streams. Some of these differences are Worth pointing out: First, unlike code division or other spread-spectrum multiple access techniques, the total Channel bandwidth utilized in a BLAST system is only a small fraction in excess of the Symbol rate, i. e. similar to the excess bandwidth required by a conventional QAM system,
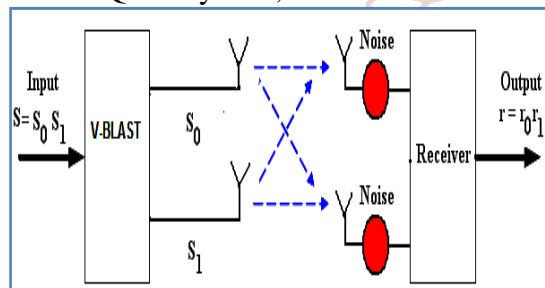

Fig. 2: V-BLAST technology

III. Additive White Gaussian Noise Channel

Additive White Gaussian Noise (AWGN) is a channel model in which the only impairment to communication is a linear addition of wideband with a constant spectral density and a Gaussian distribution of amplitude. The model does not account for fading frequency selectivity, interference, nonlinearity or dispersion. However, it produces simple and tractable mathematical models which are useful for gaining insight into the underlying be havior of a system before these other phenomena are considered. Wideband Gaussian noise comes from many natural sources, such as the thermal vibrations of atoms in conductors shot noise, black body radiation from the earth and other warm objects, and from celestial sources such as the Sun. the figure 3 shown AWGN channe
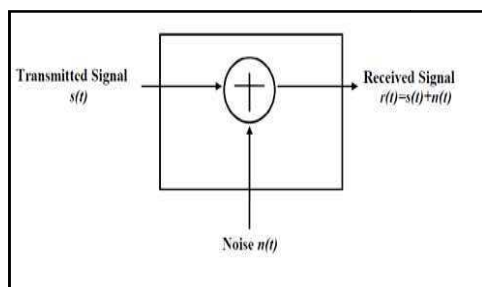

Fig. 3: AWGN Channel

IV. EQUALIZERS

The equalizer is a linear filter provides an approximate inverse of the channel response. Since it is common for the channel characteristics to be unknown or to change over time, in digital communications, purpose of equalizer is to reduce inter symbol interference to allow recovery of the transmit symbols. The ISI is imposed on the transmitted signal due to the band limiting effect of the practical channel.

A. Linear Equalizer:

A linear equalizer can be implemented as a FIR filter. It is also known as transversal filter. This type of equalizer is the simplest type available filter. In such equalizer, the current and past values of the received signal are linearly weighted by the filter coefficients.

B. MMSE Equalizer:

MMSE designs the filter to minimize $E[|e|^2]$, where e is the error signal. Mean square error algorithm takes the output of the antennas and tries to minimize the mean error of the signal. It mainly concentrates on noise power level rather than removing ISI.

C. Zero Forcing Equalizer:

It approximates the inverse of the channel with a linear filter. It tries to force bit error rate to set on zero using successive iterations. This equalizer is used when the level of added noise is very low, and so it is rarely used. Zero Forcing Equalizer is a linear equalization algorithm used in communication systems; it inverts the frequency response of the channel, which was proposed by Robert Lucky. The Zero-Forcing Equalizer applies the inverse of the channel to the received signal. The name Zero forcing corresponds to bringing down the Inter Symbol Interference (ISI) to zero in a noise free case.

V. SIMULATION RESULTS

The BER performance of the equalizers is compared with respect to the variation in E_b/N_o (dB) as seen from the simulation scripts. The used modulation techniques are BPSK and QPSK and the considered communication channel.

Table I: Simulation Parameters

Parameters	Values
Technology	V-BLAST
Algorithm	MMSE, ML
Modulation Techniques	PSK
Channel	Communication channel
Tool	Mat lab R2013a

The preferred technique for improving BER performance is V-BLAST. The data is sent through the no. of transmitting antennas and the no. of receiving antennas is used for reception. The above considered technologies have been combined using the MATLAB R2013a software.

A. Performance of MMSE Equalizer with QPSK System

The number of transmitting and receiving antennas is increase in the MIMO system with QPSK modulation technique MMSE equalizer performance increases. It is seen from the figure 4, that for 1-transmitter and 1-receiver antenna system the min value of BER is 0.015 and the max value of BER is 0.15. For 2-transmitters and 2-receivers antenna system the min value of BER is 0.004 and the max value of BER is 0.11. Similarly, for 3-transmitters and 3-receivers antenna system the min value of BER is 0.002 and the max value of BER is 0.08. Now consider 4-transmitters and 4-receivers antenna system the min value of BER is 0.0019 and the max value of BER is 0.086.
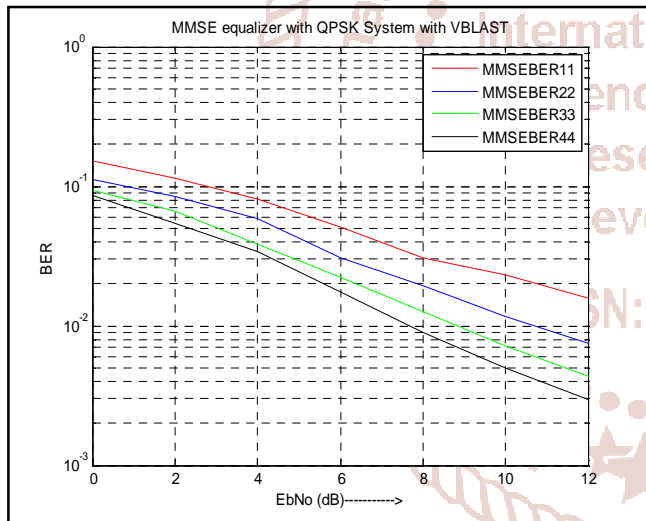

Fig. 4: MMSE Equalizers with different MIMO system

B. Performance of ML Equalizer with QPSK System

The number of transmitting and receiving antennas is increase in the MIMO system with QPSK modulation technique ML equalizer performance increases. It is seen from the figure 5 that for 1*1 antenna system the min value of BER is 0.015 and the max value of BER is 0.15. For 2*2 antenna system the min value of BER is 0.0013 and the max value of BER is 0.078. Similarly, for 3*3 antenna system the min value of BER is 0.00007 and the max value of BER is 0.042. Now consider 4*4 antenna system the min value of BER is 0.000002 and the max value of BER is 0.027.
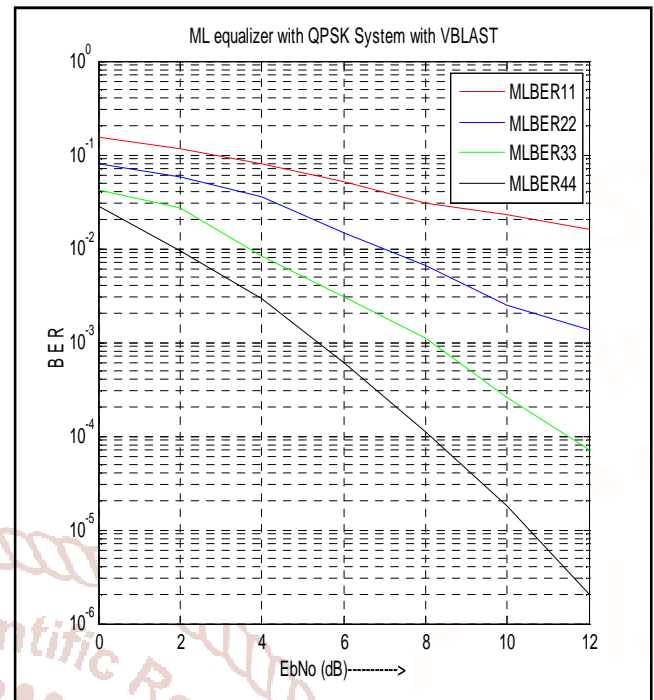

Fig. 5: ML Equalizers with different MIMO system

VI. CONCLUSION

Wireless communication is one of the most demanding areas of the communication. The Vertical Bell Labs Layered Space Time (V-BLAST) associated with MIMO system increases the performance of system in terms of Bit error Rate (BER). It also reduces overall computational complexity at the receiver. Minimum Mean Square Error (MMSE) equalizer with V-BLAST at the receiver increases performance of the system.

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