ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 13, March 2016

Analysis of Adaptive Modulation with smart Antenna Selection under Channel estimation

V. Rajalakshmi[1]
rajalakshmi1902@gmail.com
Department of ECE,
PSN College of Engineering and Technology,
Tirunelveli

Mr.S.Manikandan[2]
sl.manikandan@gmail.com
Department of ECE,
PSN College of Engineering and Technology,
Tirunelveli

***Abstract* –The performance of an adaptive modulation system in Rayleigh fading channels exploiting spatial diversity through transmit antenna selection is analysed for the case of delay constrained networks. The system combines maximal ratio com-bining at the receiver and a transmit antenna selection system which switches between available antennas and modulation schemes at the transmitter. In the delay between the channel being sampled at the receiver and acted upon by the transmitter will tend to degrade system performance. A channel prediction scheme is employed at the receiver to provide estimates of future best transmission states, which includes selecting the best transmission antenna as well as the best supported M-QAM modulation scheme. The Shannon capacity for optimal rate and constant power is derived and presented, and used as a benchmark to evaluate the spectral efficiency of the discrete rate system optimised for instantaneous BER (bit error rate) and constant power constraint.**

***Keywords* – spatial modulation, ostbc encoder and combiner, power allocation, imperfect channel state information.**

1. INTRODUCTION.

The spatial diversity, MIMO (Multiple input multiple output) technology has been shown to provide capacity gain without incurring power or bandwidth cost .The gains can be achieved by adapting to the varying channel fluctuations, by adjusting parameters such as constellation size, transmit power and code rate to match changes in the channel. The performance of adaptive modulated schemes is limited by CSI (channel state information) imperfections particularly in the form of delay in the feedback channel, which causes outdated channel information at the transmitter, thus reducing capacity. The use of imperfect channel estimates for SISO channels is investigated in, while the effect of feedback delay in adaptive modulation (AM) systems over a fading SISO has been showing the degradation of BER (bit error rate) with feedback delay. To mitigate the effect of feedback delay, channel prediction has been employed for use in SISO channels using a pilot symbol aided modulation (PSAM) technique while consider multiple antenna schemes. This paper investigates the issues relating to degraded CSI for an un-coded TAS/MRC (transmit antenna selection with maximal ratio combing) system with prediction, which adaptively adjusts modulation format based upon outdated CSI, in order to maximise spectral efficiency at a target BER. The predicted future CSI is used at the receiver to select the best switching parameters for transmission. Although the use of a feedback channel is necessary, in practice only a low bandwidth channel is required since it is simply the indices of the best predicted antenna and rate that need to be fed back. TAS is beneficial in reducing number of transmit chains and has been shown to achieve full diversity as if all the transmit antennas were used (at high SNR), outperforming STC (space time codes) of the same spectral efficiency.

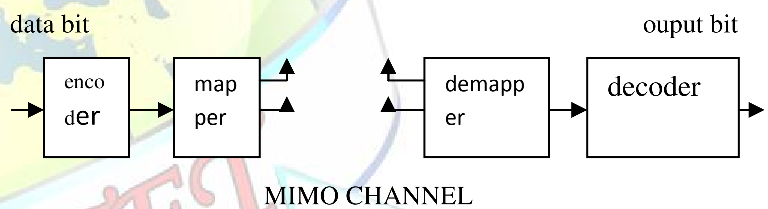

Fig 1: transmitter and receiver

The performance of non-adaptive TAS is usually limited by the quality of the channel knowledge, which is an index to the best antenna which offers the highest SNR gain amongst all transmit antennas. Large delays render the feedback information useless, effectively creating an open-loop system. In channel prediction was applied to a non-adaptive TASP/MRC (predicted TAS/MRC) system, where the effects due to delay is mitigated by predicting the antenna index at the receiver, several coherence intervals ahead. In this paper we consider an adaptively modulated TASP/MRC system, optimised for instantaneous BER (I-BER) constraint under constant. The TASP system model, the channel prediction scheme and fading PDF (probability density function) of the system. ,the Shannon capacity bound for optimal rate and constant power for the TAS/MRC scheme under prediction, and use it as a benchmark to compare our different transmission schemes. The TASP/MRC AM system the I-BER constraint with constant power scheme, and derive optimal switching boundaries for the AM system. Section VI discusses the performance analysis in terms of average BER and spectral efficiency, comparing it with non-adaptive TASP/MRC schemes has the conclusion. Notation used in that : $(.)^H$ stands for conjugate transpose, E[.] stands for expectation, I_P stands for identity matrix of size P .

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 13, March 2016

II. RELATED WORK

The speedy improvement in wireless communications & the decreased cost of communication devices, wireless networks have become denser & denser while bandwidth efficiency becomes more &more important. It is common to consider that multiple communication devices conduct transmission &reception jointly in a distributed process. Employing multiple-input multiple-output (MIMO) in wireless communication systems has been proven to present plenty of benefits in both increasing the system capacity and steadiness of reception in rich scattering atmosphere To take benefit of these a space time block coding (STBC)-oriented diversity scheme has been usually adopted in future wireless communication standards for example 3GPP LTE, WiMax, etc.

The STBC technique was originally proposed by Altamouti achieves transmit diversity exclusive of channel information. Although Alamouti's STBC was initially designed for two transmit antennas & one receive. A space-time block coding (STBC) scheme was originally anticipated by Alamouti as an effective technique to achieve a transmit diversity gain .

They increasing demands for high data rate wireless communication services requires data transmissions over wideband channels. The combination of STBC along with OFDM is deem ed to b e a promising solution for combating frequency-selective fading For both single carrier & multi-carrier transmission systems, the Altamonte scheme performs well if the channel is time in variant over two successive symbol durations. The impact of a time-varying fading channel on the performance of Alamouti transmit technique has been explored in a single-carrier system & in an OFDM system. In both the papers, the spatial correlation amid the time-varying multipath Rayleigh fading sub-channels has not been taken into account. However, it h as been revealed by simulations that the performance of a STBC-OFDM scheme depends not only on temporal correlation but also on spatial correlation. Space time Block Coding is a set of realistic signal design techniques aimed at approaching the information theoretic capacity bounds of (MIMO) channels.

Since the initial work of Alamouti in space-time coding has been a rapid growing field of research. In the last decade, numerous coding techniques have been proposed. These includes orthogonal (OSTBCs), quasi-orthogonal (QOSTBCs) & non-orthogonal STBCs. The three above mentioned equalization schemes to a relay-assisted transmission scenario, carefully utilizing the fundamental Orthogonality of distributed STBC. Most of the existing literature on cooperative diversity assumes frequency-flat fading channel..

There have been only a few sporadic results accounts on the broadband cooperative transmission techniques for frequency-selective channels.

Proposes an OFDM cooperative diversity system assuming AF relaying & derive upper bounds on the channel capacity. They also examine the achievable diversity order for distributed cooperative OFDM supposing a non-fading inter-user channel. The performance of a distributed OFDM-STBC technique through a simulation study considering both AF & decode-and-forward (DF) relaying. Building upon their preceding work on distributed STBC. The performance of a relay-assisted uplink OFDM-STBC scheme & derive an expression for the symbol error probability assuming DF with no error propagation. To the best of our knowledge, the conference version of the current paper is the first effort to investigate TRSTBC & SC-STBC in a relay-assisted transmission .

III. PROPOSED MIMO SYSTEM

The figure below shows the transmitter side block diagram of proposed scheme

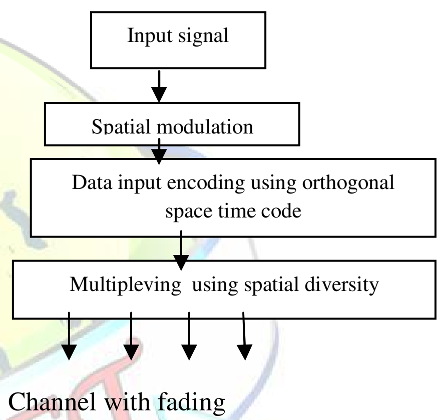

Fig 2. The transmitter side the signal is pass through constellation points with smart antenna

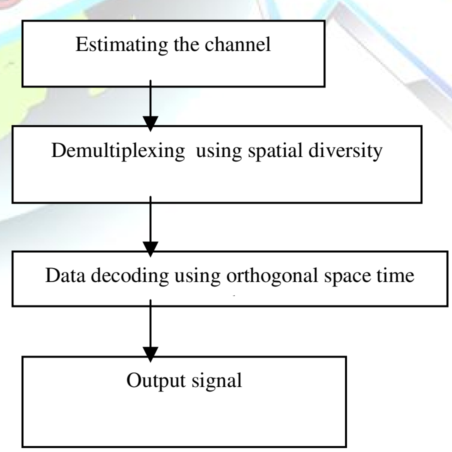

Fig 3. Receiver side the channel are allocate .

IV. SPATIAL MODULATION

Spatial modulation (SM) is a recently developed transmission technique that uses multiple antennas. The basic idea is t o map a block of information bits to two information carrying units: A symbol that was chosen from a constellation diagram and A unique transmit antenna number that was chosen from a set of transmit antennas. The use of the transmit antenna number as an information-bearing unit increases the overall spectral efficiency by the base-two logarithm of the number of transmit antennas. At the receiver, a maximum receive ratio combining algorithm is used to retrieve the transmitted block of information bits. Here, we apply SM to orthogonal spatial division multiplexing (OSDM) transmission. In general, any number of transmit antennas and any digital modulation scheme can be used. The constellation diagram and the number of transmit antennas determine the total number of bits to be transmitted on each sub-channel at each instant. The combination of BPSK and f our transmit antennas in this illustration in a total of three information bits to be transmitted on each sub-channel. Instead, four quadrature-amplitude modulation (QAM) and two transmit antennas can be used to transmit the same number of information bits. OSDM sub-channel for a sy stem that uses a QAM constellation diagram of size M (m = log 2(M)) and N transmit antennas.

$$\tilde{m} = log_2(N_t) + m$$

This shows that the constellation diagram and the number of transmit antennas can be traded off for any number of transmitted information bits. In addition, SM increases the spectral efficiency by the base-two logarithm of the total number of transmit antennas. In SM, a block of any number of information bits is mapped into a constellation point in the signal domain and a constellation point in the spatial domain. At each time instant, only one transmit antenna of the set will be active. The other antennas will transmit zero power. Therefore, ICI at the receiver and the need to synchronize the transmit antennas are completely avoided. At the receiver, maximum receive ratio combining (MRRC) is used to estimate the transmit antenna number, after which the transmitted symbol is estimated. These two estimates are used by the spatial demodulator to retrieve the block of information bits.

V. ORTHOGONAL SPATIAL DIVISION MULTIPLEXING

In our work the spatial division multiplexing is performed using discrete wavelet transform as fast Fourier transform used in orthogonal frequency division multiplexing can split the signal into frequency signal only. The transform of a signal is just another form of representing the signal. It does not change the information content present in the signal. The Wavelet Transform provides a time-frequency representation of the signal. It was developed to overcome the shortcoming of the Short Time Fourier Transform (STFT), which can also be used to analyze non-stationary signals. While STFT gives a constant resolution at all frequencies, the Wavelet Transform uses multi resolution technique by which different frequencies are analyzed with different resolutions. A wave is an oscillating function of time or space and is periodic. In contrast, wavelets are localized waves. They have their energy concentrated in time.

OSDM is a multi-carrier modulation (MCM) technique. The MCM sch eme as th e name implies is a modulation technique in which multiple carriers are used for modulating the information signals. It is a suitable modulation used for high data rate transmission and is able to mitigate the effects of inter symbol interference (ISI) and inter carrier interference (ICI). In an SFDM scheme, a huge number of orthogonal, overlapping, narrow band sub-channels, transmitted in parallel subdividing the existing transmission bandwidth. The overlapping of the sub-channels do not create any problems since the peak of one subcarrier occurs at zeroes of other subcarriers. Orthogonality between the different subcarriers is achieved by using CWT.

The digital data if first up converted parallel data. After ICWT is taken an appropriately sized cyclic prefix is appended at the end of the signal. Finally, the signal is sent into the channel. This channels either the AWGN or the flat fading Rayleigh channel. At the receiver the first task is to remove the cyclic prefix and then apply CWT. Afterwards, the parallel streams are serialized and then the symbols put through the demodulator for obtaining the input source data.

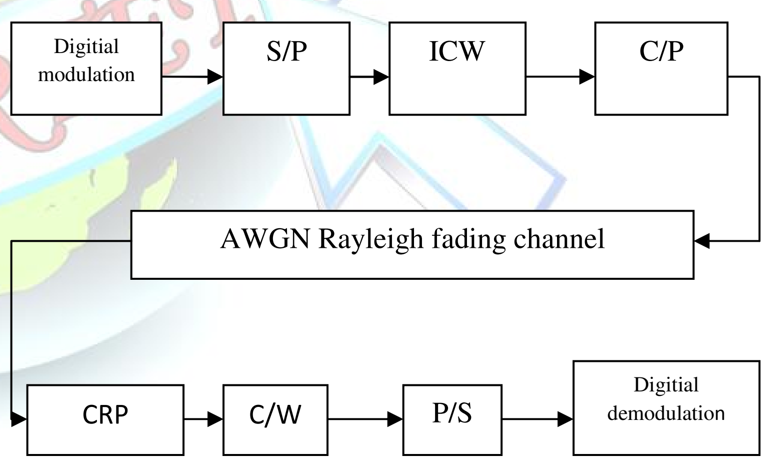

Fig 4. Block diagram

Once the cyclic prefix is removed taking IFFT of the signal is equivalent to multiplying the constellation points by sinusoids whose frequencies are equal to the frequency of a car rier signal and th en summing these products. The complex wavelet transform (CWT) is a complex-valued extension to the standard discrete wavelet transform (DWT). It is a two dimensional wavelet transform which provides multi resolution, sparse representation, and useful characterization of the structure of an image. Further, it purveys a high degree of shift-invariance in its magnitude. However, a

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 13, March 2016

drawback to th is transform is that it is exhibits (where is the dimension of the signal being transformed) redundancy compared to a separable (DWT).

Space-Time Codes (STCs) have been implemented in cellular communications as well as in wireless local area networks. Space time coding is performed in both spatial and temporal domain introducing redundancy between signals transmitted from various antennas at various time periods. It can achieve transmit diversity and antenna gain over spatially un-coded systems without sacrificing bandwidth. The research on STC focuses on improving the system performance by employing extra transmit antennas, in general, the design of STC amounts to finding transmit matrices that satisfy certain optimality criteria. Constructing STC, researchers to trade-off between three goals: simple decoding, minimizing the error probability, and maximizing the information rate.

Space-Time Coded Systems

The MIMO channels are shown in four colors to split them into four groups. The choice of a 4x 4 MIMO instead of usual 2x1 or 2x2 is motivated by the necessity of increasing diversity in the space domain and therefore robustness against fading effects together with the spectral efficiency. Nowadays, a 4-element MIMO array can be implemented with affordable cost and the yielded performance improvement in terms of spectral efficiency may justify such an additional (non-prohibitive) cost.

$$\mathbf{H} = \begin{bmatrix} h^t_{1,1} & h^t_{1,2} & \cdots & h^t_{1,n_t} \\ h^t_{2,1} & h^t_{2,2} & \cdots & h^t_{2,n_t} \\ \vdots & \vdots & \ddots & \cdots \\ h^t_{n_r,1} & h^t_{n_r,2} & \cdots & h^t_{n_r,n_t} \end{bmatrix}$$

VII. PERFORMANCE ANALYSIS

The modulation set consisting of four square M-QAM constellations corresponding to 2 (4-QAM), 4 (16-QAM), 4 (64-QAM) and 8 (256-QAM) bits per symbol. Depending on the filter order and the amount of power of the pilot, the predictor can always be made to offer greater correlation at fixed feedback delay.

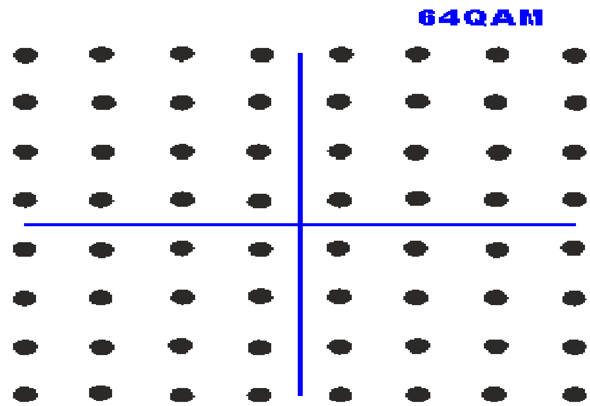

Fig 5. Constellation points

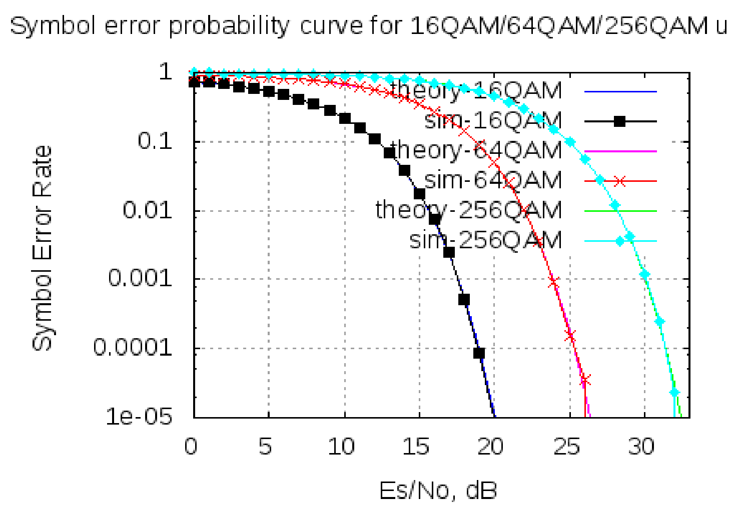

Fig 6 . comparsion of different QAM

VIII. CONCLUSION

A multi-antenna AM diversity system employing predictive antenna selection at the transm itter and MRC at the receiver, under conditions of degraded channel knowledge. The system closed form Shannon capacity gain was first derived for optimal rate adaptation at constant power with arbitrary numbers of transmit and receive antennas, which was used as a bench mark for an instantaneous BER with optimal power constraint. While it is evident that using AM in combination with multi-antenna systems, such as TAS-MRC, can greatly increase system capacity, it becomes altogether more important to preserve these gains by ensuring good quality feedback channel information the switching information which is largely responsible for those gains. Incorporating channel prediction into a TAS-MRC system is shown as being pivotal in improving system performance and in maintaining that performance in the face of CSI degradation. At the same time, it is also crucial to determine optimal operating conditions for modulation mode switching which take these prediction errors into account. In doing so the system is doubly rewarded, with improved antenna selection as well as optimal mode

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 13, March 2016

switching. TAS-MRC is seen to be a viable approach for system implementation, even in the real-world situation of outdated channel information

IX.FUTURE ENHANCEMENT

The MIMO-OSDM based systems is higher generation communication is adopt OSDMA, a multi user version of OSDM as the IMT Advanced standard for 4g +. The future work will involve simulating OSDMA physical layer along with MIMO transmit and receive diversity techniques. Also some effective channel coding schemes like Convolution Coding (CC), Turbo Coding (TC) or Low Density Parity Check (LDPC) coding could be employed for providing the flexibility of detecting and correcting errors that may occur during transmission. In information theory, TCs are a class of high-performance forward error correction (FEC) codes the use of these TCs performances that approach the channel capacity are possible. TCs have found use in 3G mobile communications and (deep space) satellite communications as well as other applications where designers seek to achieve reliable information transfer over bandwidth- or latency constrained communication links in the presence of data-corrupting noise,

REFERENCES

A. Paulraj, D. Gore, R. Nabar, and H. Bolcskei, “An overview of MIMO communications - a key to gigabit wireless,” *Proceedings of the IEEE*, vol. 92, no. 2, pp. 198 – 218, Feb. 2004.

J. Hayes, “Adaptive Feedback Communications,” *IEEE Trans. Commun. Technol.*, vol. 16, no. 1, pp. 29 –34, Feb. 1968.

J. Cavers, “Variable-Rate Transmission for Rayleigh Fading Channels,” *IEEE Trans. Commun* ., vol. 20, no. 1, pp. 15 – 22, Feb. 1972.

W. Webb and R. Steele, “Variable rate QAM for mobile radio,” *IEEE Trans. Commun.*, vol. 43, no. 7, pp. 2223 –2230, Jul. 1995.

A. Goldsmith and P. Varaiya, “Capacity of fading channels with channel side information,” *IEEE Trans. Inform. Theory*, vol. 43, no. 6, pp. 1986 –1992, Nov. 1997.

D. Goeckel, “Adaptive coding for time-varying channels using outdated fading estimates,” *IEEE Trans. Commun.*, vol. 47, no. 6, pp. 844 –855, Jun. 1999.

A. Goldsmith and S.-G. Chua, “Variable-rate variable-power MQAM for fading channels,” *IEEE Trans. Commun.*, vol. 45, no. 10, pp. 1218 –1230, Oct. 1997.

M. Alouini and A. Goldsmith, “Adaptive modulation over Nakagami fading channels,” *Wireless Personal Communications*, vol. 13, no. 1, pp. 119–143, May 2000.

S. Falahati, A. Svensson, T. Ekman, M. Sternad *et al.*, “Adaptive modu-lation systems for predicted wireless channels,” *IEEE Trans. Commun.*, vol. 52, no. 2, pp. 307–316, 2004.

J. Paris, M. Aguayo-Torres, and J. Entrambasaguas, “Impact of channel estimation error on adaptive modulation performance in flat fading,” *IEEE Trans. Commun.*, vol. 52, no. 5, pp. 716 – 720, May 2004.

G. Øien, H. Holm, and K. Hole, “Impact of channel prediction on adaptive coded modulation performance in Rayleigh fading,” *IEEE Trans. Veh. Technol.*, vol. 53, no. 3, pp. 758 – 769, May 2004.

S. Zhou and G. Giannakis, “How accurate channel prediction needs to be for transmit-beamforming with adaptive modulation over Rayleigh MIMO channels?” *IEEE Trans. Wireless Commun.*, vol. 3, no. 4, pp. 1285 – 1294, July 2004.

D. Duong and G. Oien, “Optimal Pilot Spacing and Power in Rate-Adaptive MIMO Diversity Systems with Imperfect CSI,” *IEEE Trans. Wireless Commun.*, vol. 6, no. 3, pp. 845 –851, Mar. 2007.

Z. Chen, J. Yuan, and B. Vucetic, “Analysis of Transmit Antenna Selection/Maximal-Ratio Combining in Rayleigh Fading Channels,” *IEEE Trans. Veh. Technol.*, vol. 54, no. 4, pp. 1312 – 1321, July 2005.

S. Prakash and I. McLoughlin, “Predictive Transmit Antenna Selection with Maximal Ratio Combining,” in *Proc. IEEE GLOBECOM 2009*, Nov.30-Dec. 4 2009, pp. 1–6.

J. Cavers, “An analysis of pilot symbol assisted modulation for Rayleigh fading channels [mobile radio],” *IEEE Trans. Veh. Technol.*, vol. 40, no. 4, pp. 686 –693, Nov. 1991.

W. Jakes, *Microwave mobile communications*. Wiley-IEEE Press, 1994.