ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 7, July 2017

A Review of Channel Estimation Techniques over MIMO OFDM System

Urmila Shah[1], Prof. Hardika Khandelwal[2]

M.Tech Scholar, Department of Electronics and Communication, OCT, Bhopal, M.P, India[1]

Assistant Professor, Department of Electronics and Communication, OCT, Bhopal, M.P, India[2]

ABSTRACT: The multiple input multiple output-orthogonal frequency division multiplexing (MIMO-OFDM) systems are used to fulfil the requirements of high data transmission rates, because of their unique properties such as high spectral efficiency, high data rate and resistance towards multipath propagation. MIMO-OFDM systems are finding their applications in the modern wireless communication systems like IEEE 802.11n, 4G. In this paper, we think about the design of LTE framework and overview the channel estimation. So as to accomplish high information rate correspondence with versatility, Long Term Evolution (LTE) has been presented. LTE Downlink frameworks receive Orthogonal Frequency Division Multiple (OFDM) and MIMO to give upto 100 Mbps (expecting a 2x2 MIMO framework with 20MHz transmission capacity). The execution pick up of MIMO vigorously relies upon the exact estimation of Channel State Information (CSI), which is pivotal for each interchanges framework. In this paper, we display diverse channel estimation calculations for LTE Downlink frameworks. This incorporates channel estimation utilizing Pilot Symbols and Blind Channel estimation calculations. The estimation strategies included the Least Square Error (LSE) and the Minimum Mean Square Error (MMSE) is being examined lastly analysed.

KEYWORDS: MIMO, LTE, OFDM.CSI, LSE, MMSE

I. INTRODUCTION

OFDM has been applied for various wireless communication systems in the last decade. Because of its tremendous success in digital video broadcasting (DVB) and wireless local area networks (WLANs), it is now considered for broadband wireless systems for both fixed and mobile applications such as wireless metropolitan area networks (WMANs), mobile broadband wireless access (MBWA) and proposed fourth generation (4G) cellular systems [1]. Those systems however, should be capable of working efficiently in wide range of operating conditions, such as large range of mobile subscriber station (MSS) speeds, different carrier frequencies in licensed and licensed-exempt bands, various delay spreads, asymmetric traffic loads in downlink and uplink and wide dynamic signal- to-noise ratio (SNR) ranges.

The raising requests for fast and solid remote interchanges have prodded improvement of different input–multiple-output (MIMO) frameworks with various radio wires at every transmitter and beneficiary sides. To effectively collect the ability and assortment increases realistic by MIMO channels, various space-time continuum process strategies have been produced, for example, Bell Labs layered space-time continuum models and orthogonal space-time continuum piece codes, to give some examples. To additionally upgrade the framework ability, data theoretic research demonstrates that an input channel can be used to give channel state data (CSI) to the source angle, which could affect shut circle capacity picks up essentially once the lucidness time of the MIMO channel is adequately expansive. At the point when brilliant criticism of CSI is inaccessible because of many-sided quality or utility limitations, the execution furthest reaches of MIMO frameworks under uproarious or quantized input are assessed in the investigation. Various input systems are conceived to comprehend the nearby circle capacity pick up. In control plans in view of quantized criticism information are intended to lessen an upper bound of numerous input–single-output (MISO) framework. At what time just the list of the most incredible pillar shaping vector is nourished back to the transmitter, the issue of quantized most flag to-clamor proportion (SNR) shaft framing is settled inside the examination. Under input connect

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 7, July 2017

capacity requirement, a half and half bar shaping and versatile power-control engineering is created in the investigation. For scalar power criticism and per-recieving wire vector control input, the issue of ideal MIMO interface limit is ascertained in the examination, while the issue of ideal MIMO multiuser configuration is tackled in the investigation in. As of late, two point by point type of fragmentary criticism, particularly, channel mean input (CMF) and channel covariance input (CCF), incorporate be explore for moderate differing and rapidly changing MIMO channels, separately. In light of CMF, ideal multiantenna communicate precoder design has been seek after in the investigation, while with CCF, a required and sufficient condition for the optimality of beam shape is gotten in the examination. The blunder execution of versatile regulation with deferred reaction, least mean square mistake (MMSE) channel forecaster, and communicate shaft shaping is explored in the investigation. As per the writing, the pilot image helped balance has as of late risen as a promising MIMO estimator utilized for time-shifting remote correspondence frameworks. It offers attractive introduction with viable registering many-sided quality. In this way, the utilization of PSAM approach perform channel deduction is prescribed here for handy setting. In this exertion, an execution investigation of the novel pilot image helped adjustment framework chipping away at MIMO channels and TCM-STBC codes are investigated. Here are two for the most part characterized TCM classes: the anticipated TCM and the multidimensional trellis coded adjustment which is known to give high transmission capacity effectiveness. In this paper, we concentrate on the execution investigation of the second sort of TCM as an external code. We consider here on the perceived four multidimensional TCM (4D-TCM) plot depicted in which offers high information rate.

II. LITERATURE REVIEW

A wide An extensive variety of research techniques is utilized for divert estimation in LTE-OFDM is introduced here. The assessed works are group the diverse channel estimation techniques like pilot based, daze channel, LMS and RLS, LS and MMSE and other channel estimation strategies.

Emna Ben Slimane et. al. [1] "Pilot Assisted Channel Estimation in MIMO-STBC System Over Time-Varying Fading Channels" In this anticipated work challenges about the arrangement of direct state data in various information and different yield (MIMO) framework base on space time piece codes (STBC) on moderate time-changing Rayleigh blurring channels are address. We built up a novel MIMO channel estimation calculation to embrace a pilot image helped tweak (PSAM) which has been ended up being useful for blurring channels. In this propel, pilot images are an ideal opportunity to time embedded into the information stream that is sent by the orthogonal STBC encoder. At the recipient point, we plan an essential MIMO channel estimation technique past to being utilized by STBC decoder. right and direct PSAM estimation strategy is expected for MIMO in view of orthogonal STBC codes. The transmitter simply embed known ideally and similarly paced pilot image in information data piece. The join flag is coded by utilizing orthogonal STBC code. The transmitted flag is defiled by added substance clamor and moderate blurring. The moderate blurring channel is demonstrated by the Jakes show; it is additionally been enduring over the STBC codeword stage. The recipient assess and introduces the channel limit gave by pilot images with a specific end goal to accomplish the sufficiency and the stage reference for location. Reproduction result demonstrate that channel estimation base on PSAM strategy is right in wording BER for both MIMO plans. The benefit of this procedure is its accomplishment ease notwithstanding the aggressive execution. It is additionally demonstrated that estimation strategy is ideal for moderate time-changing blurring channels and can be reached out to quick time-fluctuating blurring channels.

Twosome Zhang, et. al. [2] "On the cutoff points of Feedback Rates for Pilot-Assisted MIMO Systems" For pilot-help different info numerous yield (MIMO) framework with deficient input, we inspect the relationship in the middle of the criticism transmission rate and coming about pick up of shut circle limit. In view of this relationship evaluate by rate-twisting hypothesis, we analyze the upper and lower limits of the input rate that would influence pick up of positive shut circle limit without unreasonably devouring criticism transmission assets. across the board recreations are complete to approve the diagnostic outcome and to reveal insight into the achievable shut circle MIMO limit given the framework plan parameterized by the quantity of radio wires, pilot control designation, transmit motion to-commotion proportion, and limited input rate.

Mohamed Marey, et. al [4] "Dazzle STBC Identification for Multiple-Antenna(MA) OFDM Systems" The issue of space time piece distinguishing proof for different radio wire orthogonal recurrence division multiplexing (FDM) frameworks working over recurrence specific channels without precedent for writing. Past examinations

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 7, July 2017

accessible on the subject of STBC ID were restricted to single-bearer frameworks working on recurrence level channels. OFDM frameworks make this subject all the more difficult to deal with since the identifiers works in recurrence specific channels with nearly nothing or without information of the start of the OFDM squares, recurrence particular channel coefficients.

Leandro D'Orazio, et.al.[5] "MMSE Multi User Detection with GA-helped Channel Estimation for STBC MC-CDMA Mobile Communication Systems" MIMO MC-CDMA method have been arranged keeping in mind the end goal to build framework limit through recurrence particular remote channels. The key normal for MIMO MC-CDMA is the capability of abusing range together in time, space and recurrence areas. Specifically, Alamouti's coding plan has been anticipated as an exceptionally basic and logically rich instrument with a specific end goal to put without hesitation space-time piece coding. The primary trouble to be tended to will be to productively recombine assortment keeping in mind the end goal to accomplish the best execution within the sight of multi-client impedance.

Citation	Title	Journal Name/Year	Research scope
[1]	Pilot Assisted Channel Estimation in MIMO-STBC System Over Time-Varying Fading Channels	IEEE International Workshop on Resource Allocation 2016	In it a accurate and straightforward PSAM estimation method is proposed for MIMO based on Orthogonal STBC codes.
[2]	On the limits of Feedback Rates for Pilot-Assisted MIMO Systems	IEEE TRANSACTI-ONS ON VEHICULAR TECHNOLOGY June 2015	In this results provide guideline on the feedback channel for meaningful designs of practical pilot-assisted MIMO systems.
[3]	A Comb-Type Pilot Symbol Aided Channel Estimation for the STBC based OFDM System over Frequency Selective Channel	IEEE Asia Pacific Conference 2013	In it comb type pilot arrangement with different interpolation method for STBC based OFDM system is Investigated over multipath fading channel.
[4]	Blind STBC Identification for Multiple-Antenna(MA) OFDM Systems	IEEE TRANSACTIONS ON COMMUNICATIONS, May 2014	A novel STBC-OFDM identification method is proposed.
[7]	Training-Based MIMO Channel EstimationA Study of Estimator Tradeoffs and Optimal Training Signals	IEEE TRANSACTIONS ON SIGNAL PROCESSING, MARCH 2006	The performance of several training-based MIMO channel estimation is realize

III. METHOD

A. STBC BASED OFDM SYSTEM MODEL

The framework display for STBC-OFDM with two transmission radio wire and a get recieving wire is appeared in the Fig1. then again, the framework model can be reached out to any no.of transmitting and getting reception

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 7, July 2017

apparatuses to get high transmit decent variety. At the transmitter end, the information succession is produce and balance as per any positive tweak plan, for example, QPSK, BPSK or 16QAM. After this the yield balanced information is gone through STBC encoder. The STBC encoder use to change the single information adjusted data information into two parallel encoded yield information by utilizing Alamouti STBC plot. The pilot grouping is additionally produced and regulates comparably to the information succession. After that both encoded information and pilot subcarrier go by the serial to parallel converter lastly came to at the (IFFT) Inverse Fast Fourier Transformation piece. The yield of the IFFT square communicated as

$$x_{t,n}^{\beta} = \sum_{k=0}^{N-1} X_{t,k}^{\beta} e^{j 2\pi kn / N}$$
$$\beta = 1, 2, \quad n, k = 0, 1, 2, \ldots . N - 1 \qquad (1)$$

Where data vector denotes by $X_{t,k}^{\beta}$, $x_{t,n}^{\beta}$ before and after of the IFFT block,β denote the transmitting antenna index, and n, k represents the kth subcarrier and the its nth time instant at the tth symbol period. Where N denote the total number of OFDM data subcarrier. at last, the resulting signals are transmitted from the antennas following insertion of the cyclic prefix (CP) which is assumed to be largas compare to the delay spread of the multipath channel to avoid inter symbol interferences (ISI).The channel is assumed to be static or quasi-static for two time slot of STBC block . The channel model use in this paper is describe latter in this segment. The received signal can be obtain by taking the difficulty of transmitted data signal with the channel impulse reaction and can be expressed in term as

$$r_{j,t,n} = \sum_{l=0}^{L-1} h_{j,t,l}^{\beta} x_{t,n-l}^{\beta} + w_{j,t,n} \qquad (2)$$

$H_{j,t,k}^{\beta}$ denote the frequency response of the channel from β th transmitting antenna to the j^{th} receiving antenna and on the k^{th} subcarrier. Nt and Nr represent the quantity of transmit and receive antennas. $W_{j,t,k}$ Is the additive white Gaussian noise with zero mean and unit variance. After the processed signal is decoded by the STBC decoding method. to conclude, the transmitted signal is recovers after taking the hard resolution of the decoded signal. In this paper, IEEE802.11 model with exponential power delay profile is adopted. The channel is modeled as finite impulse response with total L+1 non-zero path and with zero mean and average power of σ_1^2 . The channel can be expressed as

$$h_1 = N(0, \frac{\sigma_1}{2}) + jN(0, \frac{\sigma_1}{2}) \qquad (4)$$

Where $N(0, \frac{\sigma_1}{2})$ is zero mean with variance σ_1^2

power of the multipath component decreases exponentially. The first path of the model is choose to be

$$\sigma_0^2 = \frac{1-\lambda}{1-\lambda^{L+1}} \qquad (5)$$

Where $\lambda = e^{\frac{T_S}{\tau_{rms}}}$ and $L = \frac{10\tau_{rms}}{T_s}$ The Ts and τ_{rms} are the root mean and sampling period squared delay of the channel respectively. The energy of lth path can be written like

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 7, July 2017

$$\sigma_l^2 = \sigma_0^2 \lambda^l \quad (6)$$

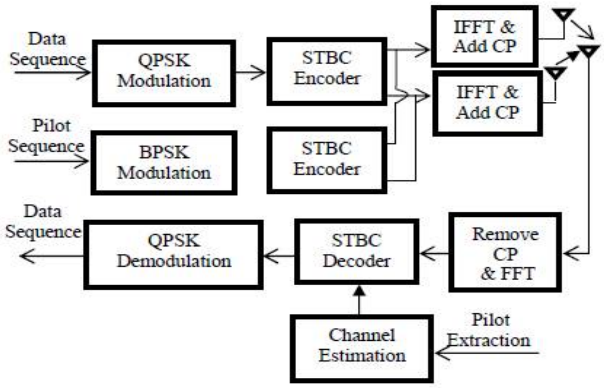

Figure 1 Block diagram of an STBC-OFDM system model.

IV. CONCLUSION

In this paper, In this paper, the basic concepts of Orthogonal Frequency Division Multiplexing (OFDM), Multiple Input Multiple Output (MIMO) systems are addressed. The various channel estimation techniques such as STBC , training based, blind channel, semi-blind channel based algorithms are discussed. Also different optimization techniques, such as Decision Directed Channel Estimation Implementation for Spectral Efficiency Improvement in Mobile MIMOOFDM, Adaptive Channel Estimation Techniques for MIMO-OFDM Systems are reviewed for training based channel estimation algorithms.

REFERENCES

[1] Jin-Taek Lim∗ and Dong-Ho Cho†"Gain Analysis of Adaptive MIMO Semisoft in LTE-OFDM Systems" 978-1-4799-8088-8/15/$31.00 201 5 IEEE.
[2] Duo Zhang, Guo Wei, Jinkang Zhu, Zhi Tian, " On the Bounds of Feedback Rates for Pilot-Assisted MIMO Systems" IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 56, NO. 4, JULY 2007.
[3] Jyoti P. Patra, Poonam Singh, " A Comb-Type Pilot Symbol Aided Channel Estimation for STBC based OFDM System over Frequency Selective Channel" 978-1-4799-2751-7/13/$31.00 Â©2013 IEEE
[4] Mohamed Marey, Octavia A. Dobre, Robert Inkol, "Blind STBC Identification for Multiple-Antenna OFDM Systems" IEEE TRANSACTIONS ON COMMUNICATIONS, VOL. 62, NO. 5, MAY 2014 0090-6778/14$31 2014 IEEE
[5] Leandro D'Orazio, Claudio Sacchi, Massimo Donelli, Francesco G.B. De Natale, " MMSE Multi-User Detection with GA-assistedchannel Estimation for STBC MC-CDMA Mobile Communication Systems" 978-1-4244-2204-3/08/$25.00 ©2008 IEEE
[6] V. Tarokh, H. Jafarkhani, and A. R. Calderbank, "Space-time blockcodes from orthogonal designs," IEEE Trans. Inf. Theory, vol. 45, no. 5, pp. 1456-1467, Jul. 1999.
[7] M. Biguesh and A. B. Gershman, 'Training-based MIMO channel estimation: A study of estimator tradeofls and optimal training signals," IEEE Trans. Signal Process., vol. 54, no. 3, pp. 884-893, Mar. 2006.
[8] J.K. Cavers, "An Analysis of Pilot Symbol Assisted Modulation for Rayleigh Fading Channels," IEEE Trans. on Veh. Tech., vol. 40, no.4, pp. 686--693, Nov. 1991.S. Ohno and G. B. Giannakis, "Average-rate optimal PSAM transmissions over time-selective fading channels," IEEE Trans.Wireless Commun., vol. I, no. 4, pp. 712-720, Oct. 2002.
[9] K. Yu, 1. Evans, and 1. Collings, "Performance analysis of pilot symbol aided QAM for Rayleigh fading channels," in Proc. IEEE ICC, New York, NY, pp. 1731-1735, May 2002.
[10] S.S. Ikki, S. AI-Dharrab and M. Uysal, "Error Probability of OF Relaying with Pilot-Assisted Channel Estimation over Time-Varying Fading Channels," IEEE Transactions on Vehicular Technology, vol.61,no. I,393 - 397,2012.
[11] Wenyu Li, Yunfei Chen and Norman C. Beaulieu, "BER Optimization of Pilot Symbol Assisted MRC PSI(for Slow Fading Channels " IEEE Communications Letters, vol. 13, no. 12, December 2009.
[12] Eiji Okamoto, Huan-Bang Li, and Tetsushi Ikegami, "A Pilot Symbol Assisted Compensation Scheme of Fading and Frequency Offset for 16QAM," IEEE International Conference on Universal Personal Communications (ICUPC), vol. 2, pp. 921 - 924, 2008.