iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** I **Month of publication:** January 2022

DOI: https://doi.org/10.22214/ijraset.2022.39776

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue I Jan 2022- Available at www.ijraset.com

Channel Estimation for MIMO Systems

Sonti Swapna
PG Student, Department of ECE, UCEK, JNTUK

Abstract: A combination of multiple-input multiple-output (MIMO) systems and orthogonal frequency division multiplexing (OFDM) technologies can be employed in modern wireless communication systems to achieve high data rates and improved spectrum efficiency. For multiple input multiple output (MIMO) systems, this paper provides a Rayleigh fading channel estimation technique based on pilot carriers. The channel is estimated using traditional Least Square (LS) and Minimum Mean Square (MMSE) estimation techniques. The MIMO-OFDM system's performance is measured using the Bit Error Rate (BER) and Mean Square Error (MSE) levels.
Keywords: MIMO, MMSE, Channel estimation, BER, OFDM

I. INTRODUCTION

Mobile communication systems use changes in the amplitude and phase of radio waves to deliver bits of data. The receiving side of a mobile system's amplitude or phase may vary significantly. This lowers system quality since the receiver's performance is strongly reliant on the correctness of the estimated instantaneous channel. As a result, a channel estimate technique is utilised to improve the accuracy of the received signal. Inter symbol interference (ISI) occurs in the received signal in mobile communication systems because radio channels are frequently multi path fading channels. A variety of detection methods are used on the receiver side to remove ISI from the signal. The channel impulse response (CIR), which can be produced using a different channel estimator, is required by these detectors.

OFDM (Orthogonal Frequency Division Multiplexing) is a multi-carrier modulation technology that allows high-speed data streams to be transmitted across wireless networks. It divides the high-rate data stream into multiple lower-rate data streams that are delivered simultaneously over many subcarriers. This approach also eliminates inter-symbol interference (ISI).

It also permits sub-carrier bandwidth to overlap without causing inter-carrier interference (ICI). In OFDM, a specific set of orthogonal carrier frequencies can be used to obtain high spectral efficiency.

II. OFDM SYSTEMS

Each channel in a digital communications system must operate at a specified frequency and with a specific bandwidth. In truth, communication systems have evolved to allow for the transmission of the greatest quantity of data over a finite frequency range. In this paper, we'll look at how communications systems have recently evolved to use a variety of strategies to effectively use the frequency spectrum. We'll go through how frequency division multiplexing (FDM) and orthogonal frequency division multiplexing (OFDM) can effectively use the frequency spectrum in more detail. Furthermore, we will separate the two and explain why OFDM systems are now being used in some of the most modern and cutting-edge communications systems.

III.MIMO SYSTEMS

Multiple-Input MIMO (Multiple-Input Multiple-Output) is a wireless technology that increases the data capacity of an RF radio by using multiple transmitting and receiving antennas. In a MIMO system, the same data is supplied across several antennas along the same channel and in the same bandwidth. As a result, each signal reaches the receiving antenna through a different path, resulting in more reliable data. The number of transmit and receive antennas is similarly proportional to the data rate. The receiver is designed to account for minor delays in signal reception as it travels via several paths, as well as any added noise or interference, and even lost communications.

All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

A. Benefits of MIMO systems

Because they use bounced and reflected RF waves, MIMO systems give better signal strength even when there is no clear line-of-site.

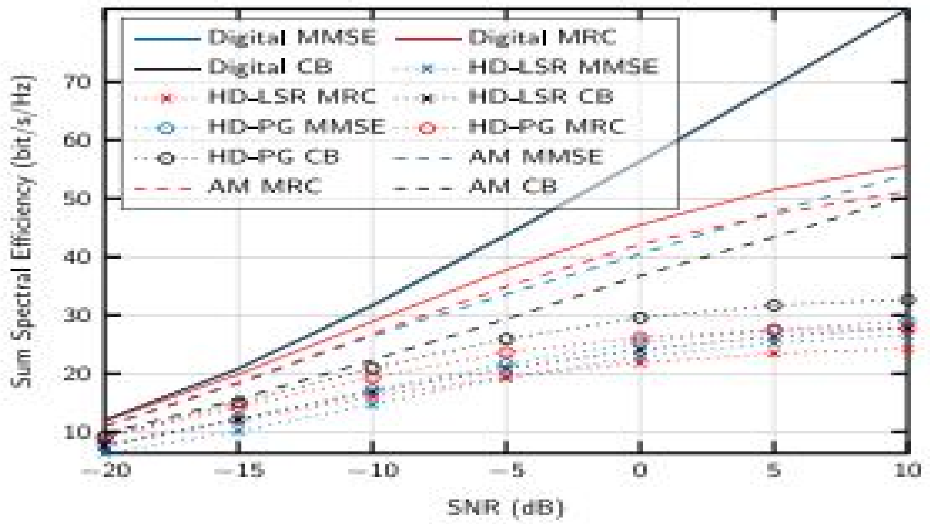
Because of the faster throughput, the quality and quantity of video broadcast via the network can be improved.

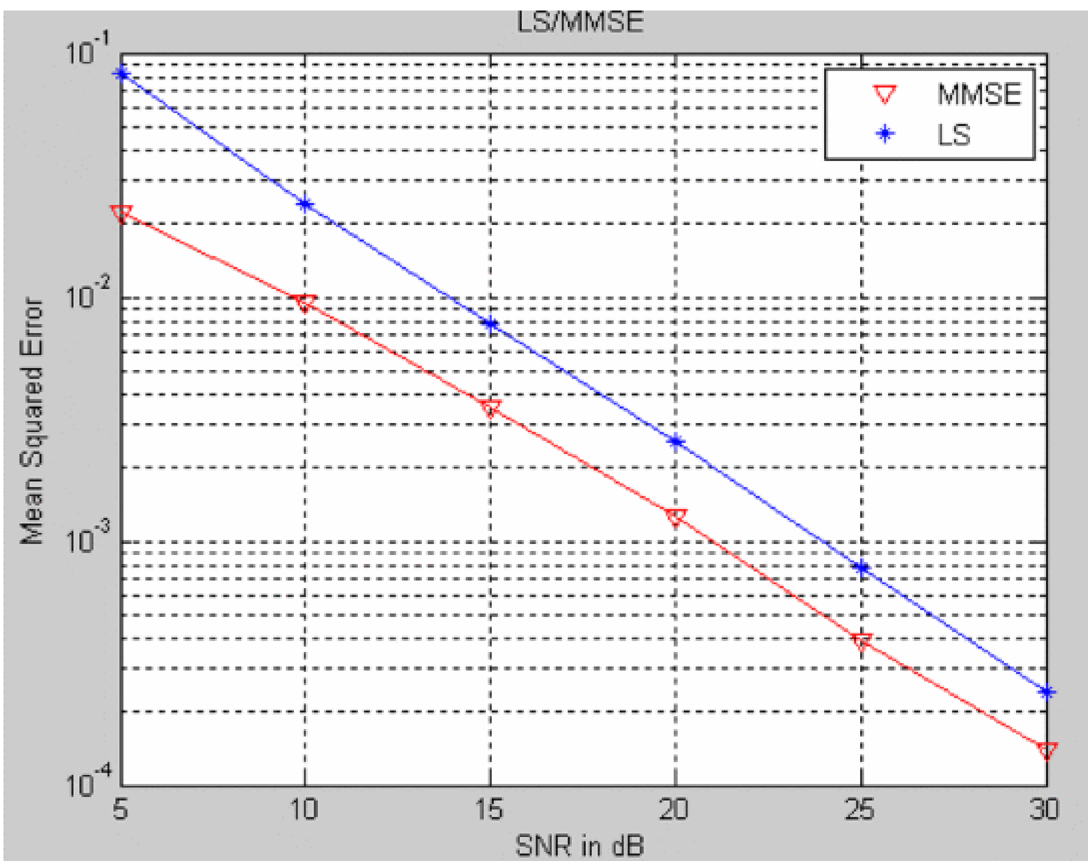
The frequency of lost data packets is reduced when many data streams are used, resulting in greater video or audio quality.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue I Jan 2022- Available at www.ijraset.com

Typical MIMO setups include:
MIMO 2x2 (two transmit antennas, two receive antennas)
MIMO 3x3 (three transmit antennas, three receive antennas)
MIMO 4x4 (four transmit antennas, four receive antennas)
MIMO 8x8 (eight transmit antennas, eight receive antennas)

IV.RESULTS





V. CONCLUSION

The channel estimation on a MIMO-OFDM system for a Rayleigh fading channel is investigated in this study. Two alternative techniques, LS channel estimation and MMSE channel estimation, are used, and simulation is carried out. The simulation findings show that in a MIMO- OFDM system, MMSE channel estimation has lower MSE and BER than LS channel estimation, and that channel estimation utilising comb type pilot carrier has lower BER than block type pilot carrier. As a result, the MMSE channel estimator outperforms the LS channel estimator.

VI. REFERENCES

1) Kala Praveen Bagadi, Prof. Susmita Das "MIMO OFDM channel estimation using pilot carriers",International Journal of computer applications,vol 2,no.3,May 2010.
2) A. Petropulu, R. Zhang, and R. Lin, "Blind OFDM channel estimation through simple linear pre-coding", IEEE Transactions on Wireless Communications, vol. 3, no.2,March 2004, pp. 647-655.
3) Osvaldo Simeone, Yeheskel Bar-Ness, Umberto Spagnolini,"Pilot-Based Channel Estimation for OFDM Systems by Tracking the Delay-Subspace", IEEE Transactions on Wireless Communications, Vol. 3, No. 1, January 2004.
4) Siavash M. Alamouti, "A Simple Transmit diversity Technique for Wireless Communications", IEEE Journal on Select Areas in Communications, Vol. 16, No. 8, October1998.

A. References

The heading of the References section must not be numbered. All reference items must be in 8 pt font. Please use Regular and Italic styles to distinguish different fields as shown in the References section. Number the reference items consecutively in square brackets (e.g. [1]).

When referring to a reference item, please simply use the reference number, as in [2]. Do not use “Ref. [3]” or “Reference [3]” except at the beginning of a sentence, e.g. “Reference [3] shows …”. Multiple references are each numbered with separate brackets (e.g. [2], [3], [4]–[6]).

Examples of reference items of different categories shown in the References section include:

- example of a book in [1]
- example of a book in a series in [2]
- example of a journal article in [3]
- example of a conference paper in [4]
- example of a patent in [5]
- example of a website in [6]
- example of a web page in [7]
- example of a databook as a manual in [8]
- example of a datasheet in [9]
- example of a master’s thesis in [10]
- example of a technical report in [11]
- example of a standard in [12]

VII. CONCLUSIONS

The version of this template is V2. Most of the formatting instructions in this document have been compiled by Causal Productions from the IEEE LaTeX style files. Causal Productions offers both A4 templates and US Letter templates for LaTeX and Microsoft Word. The LaTeX templates depend on the official IEEEtran.cls and IEEEtran.bst files, whereas the Microsoft Word templates are self-contained. Causal Productions has used its best efforts to ensure that the templates have the same appearance.

Causal Productions permits the distribution and revision of these templates on the condition that Causal Productions is credited in the revised template as follows: “original version of this template was provided by courtesy of Causal Productions (www.causalproductions.com)”.

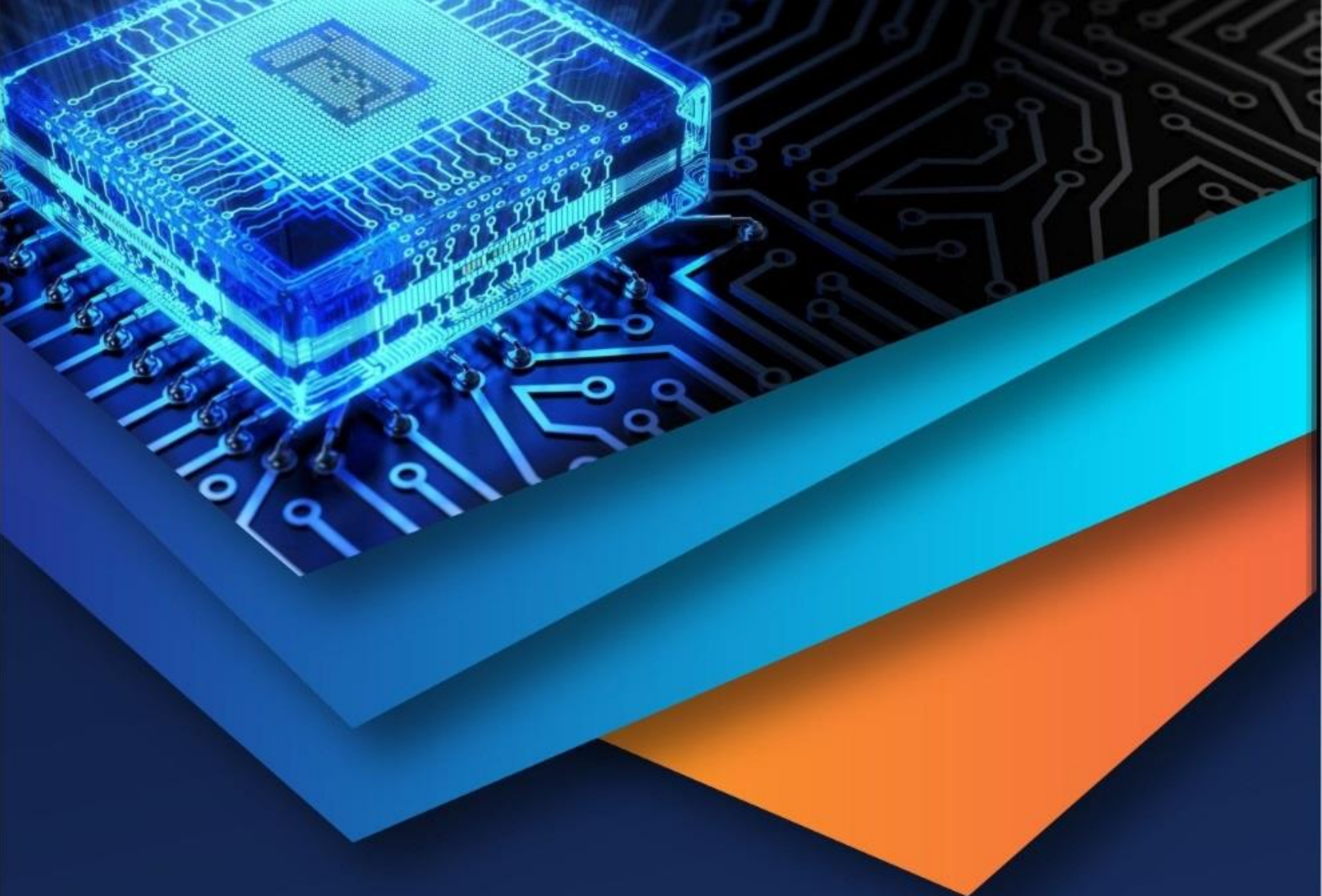
VIII. ACKNOWLEDGMENT

The heading of the Acknowledgment section and the References section must not be numbered.

Causal Productions wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template. To see the list of contributors, please refer to the top of file IEEETran.cls in the IEEE LaTeX distribution.

REFERENCES

[1] S. M. Metev and V. P. Veiko, Laser Assisted Microtechnology, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.
[2] J. Breckling, Ed., The Analysis of Directional Time Series: Applications to Wind Speed and Direction, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
[3] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, “A novel ultrathin elevated channel low-temperature poly-Si TFT,” IEEE Electron Device Lett., vol. 20, pp. 569–571, Nov. 1999.
[4] M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, “High resolution fiber distributed measurements with coherent OFDR,” in Proc. ECOC’00, 2000, paper 11.3.4, p. 109.
[5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, “High-speed digital-to-RF converter,” U.S. Patent 5 668 842, Sept. 16, 1997.
[6] (2002) The IEEE website. [Online]. Available: http://www.ieee.org/
[7] M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEEtran/
[8] FLEXChip Signal Processor (MC68175/D), Motorola, 1996.
[9] “PDCA12-70 data sheet,” Opto Speed SA, Mezzovico, Switzerland.
[10] A. Karnik, “Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP,” M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
[11] J. Padhye, V. Firoiu, and D. Towsley, “A stochastic model of TCP Reno congestion avoidance and control,” Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
[12] Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, IEEE Std. 802.11, 1997.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY