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Estimation of Channel Capacity in MIMO-OFDM System

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Abstract: In this new information age, high data rate and strong reliability features our wireless communication systems and is becoming the dominant factor for a successful deployment of commercial networks. MIMO-OFDM (multiple input multiple output orthogonal frequency division multiplexing), a new wireless broadband technology, has gained great popularity for its capability of high rate transmission and its robustness against multi-path fading and other channel impairments. A major challenge to MIMO-OFDM systems is how to obtain the channel state information accurately and promptly for coherent detection of information symbols and channel synchronization.

Keywords: MIMO: multiple input multiple output.

INTRODUCTION

High transmission data rate, spectral efficiency, and reliability are necessary for future wireless communications systems. Unlike Gaussian channels, wireless channels suffer from attenuation due to multipath in the channel. Multiple copies of a single transmission arrive at the receiver at slightly different times. Without diversity techniques, severe attenuation makes it difficult for the receiver to determine the transmitted signal. Diversity techniques provide potentially less-attenuated replica(s) of the transmitted signal at the receiver. Multiple-Input Multiple-Output (MIMO) antenna systems are a form of spatial diversity [1]. In a multipath-rich wireless channel, deploying multiple antennas, at both the transmitter and receiver, achieves high data rate without increasing the total transmission power or bandwidth. Additionally, the use of multiple antennas at both the transmitter and receiver provides significant increase in capacity .

MIMO SYSTEM ARCHITECTURE

Multiple Input Multiple Output (MIMO) Communication systems are the latest advances in the wireless communication system. As mentioned earlier, such systems can provide higher data rate and better performance without any cost on the radio spectrum side [10]. Figure 2 shows a typical block diagram for a MIMO communication system.

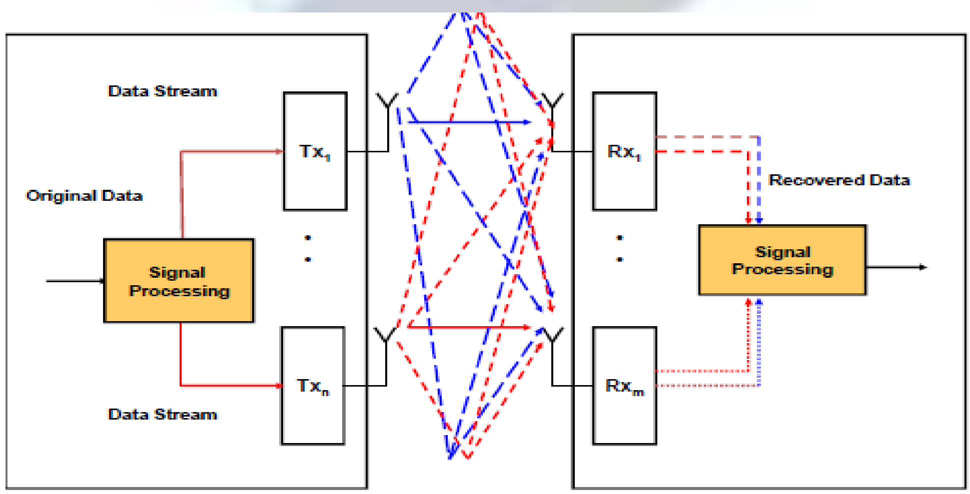

Fig 1: Overview of a MIMO wireless communication system

Transmit/receive antenna diversity, referred to as spatial diversity, represents a powerful means of combating the effects of fading. Systems with multiple antennas are referred to as Multi Input Multi Output (MIMO) Systems. One of the major advantages of MIMO systems is substantial increase in the channel capacity, which immediately translates to higher data throughputs [7].

ENCODING TECHNIQUES

The use of multiple antennas, both at the transmitter and receiver, has gained a lot of interest over the past decade. Various techniques have been proposed to take advantage of the diversity offered by this Multi Input Multi Output (MIMO) setup. The MIMO system that increase the benefits of diversity compared to traditional wireless system, called Space Time Block Code (STBC) [3]. In addition, the MIMO system can also increase the benefits of channel capacity and multiplexing gain in wireless system, called Spatial Multiplexing (SM) [4].

Space Time Block Code (STBC)

The most famous space-time block code was proposed by Alamouti in 1998 [11].

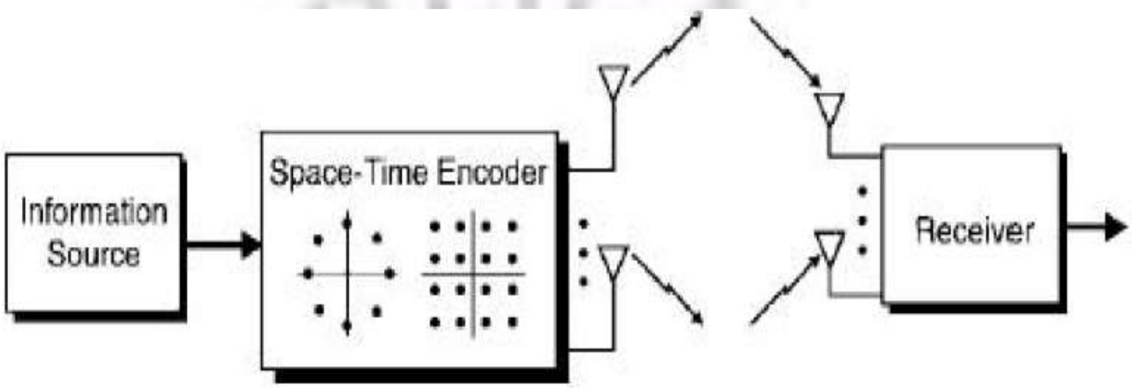

Fig 2: System block diagram of space-time coding

The input symbols to the space–time block encoder are divided into groups of two symbols each. At a given symbol period, the two symbols in each group $\{s_0,s_1\}$are transmitted simultaneously from from the two antennas. Spatial Multiplexing (SM) By using MIMO Spatial Multiplexing, the transmitted signal (S), received signal (R), noise signal (N) and MIMO channel (H) can be expressed as [4].

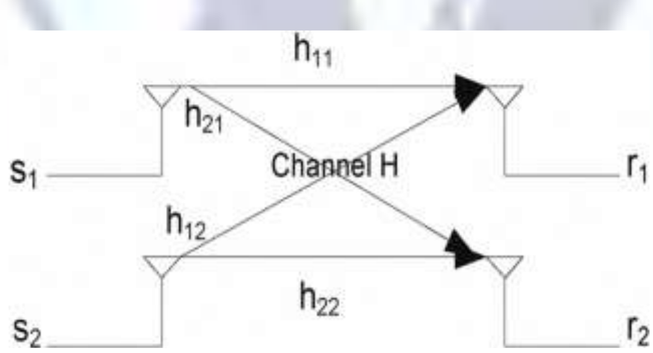

Fig 3: A 2*2 MIMO System

CHANNEL ESTIMATION IMPLEMENTATION USING MATLAB

The channel impulse response is estimated based on the known training sequence, which is transmitted in every transmission burst. We assume that the channel conditions remain the same during the transmission of each burst. We will first send the known training sequences. Since, receiver has the knowledge about the information being sent ,the channel impulse response can be estimated.

SIMULATION RESULT

COMPARISON BETWEEN KNOWN CHANNEL AT RECEIVER VS. CHANNEL ESTIMATED USING LS METHOD

Here is the simulation result of the performance of such a scheme with two receive antennas (i.e., a 2x2 system) with and without channel estimation. In the realistic scenario where the channel state information is not known at the receiver, this has to be extracted from the received signal. We assume that the channel estimator performs this using orthogonal pilot signals that are prepended to every packet . It is assumed that the channel remains unchanged for the length of the packet (i.e., it undergoes slow fading).

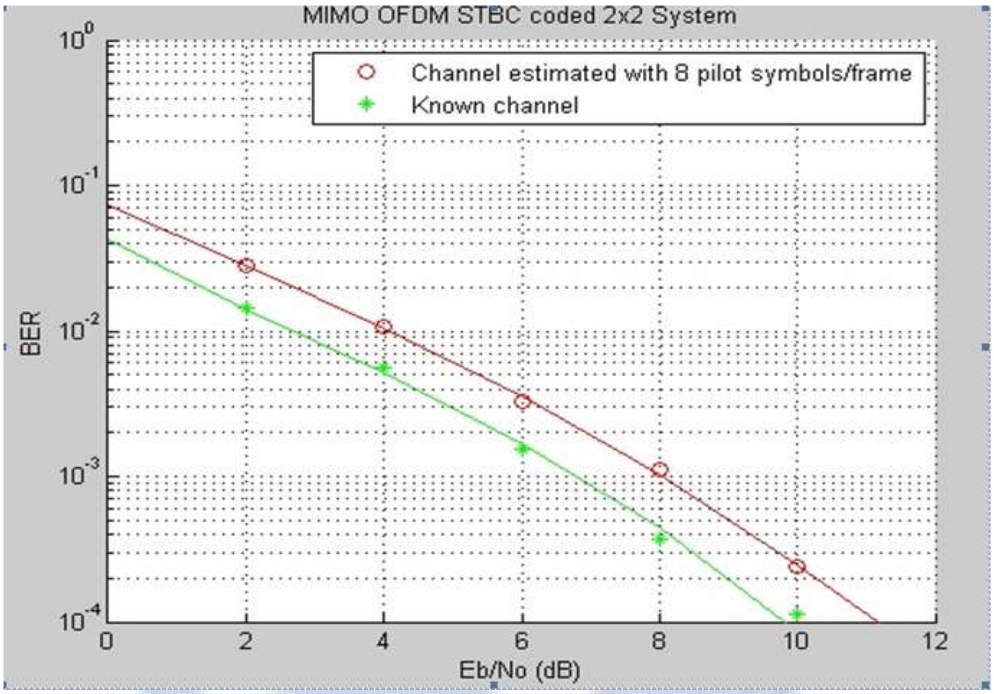

Figure 5.1: Comparison Channel Estimated v/s Known Channel

CONCLUSION

The thesis presents a approach that model channel estimation. It is also shown that the estimation is usually based on the known training bits and corresponding received samples. In this report comparison between different channel estimation techniques has been done. Channel estimation techniques are simulated in MATLAB and the simulated results are compared with known channel at receiver.

REFERENCES

[1]. D.B.Bhoyar, Vaishali B. Niranjane "Channel Estimation for MIMO-OFDM Systems" International Journal of Engineering Research and Applications (IJERA), Vol. 2, Issue 1, Jan-Feb 2012, pp.044-050

[2]. Kala Praveen Bagadi, Prof. Susmita Das, "MIMO-OFDM Channel Estimation using Pilot Carries" International Journal of Computer Applications (0975 – 8887) Volume 2 – No.3, May 2010 pp. 81-88

[3]. Risanuri Hidayat, Anggun Fitrian Inawati an Budi Setiyanto "Channel Estimation in MIMO-OFDM Spatial Multiplexing Using Least Square Method" International Symposium on Intelligent Signal Processing and Communication Systems (lSPACS) December 7-9,2011

[4]. 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

[5]. 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, pp.315-325.

[6]. F.Delestre and Y.Sun, "Pilot Aided Channel Estimation for MIMO-OFDM Systems", Proceedings of London Communications Symposium, June 2009, pp 356-360.

[7]. C. Tellambura, Y.J. Guo, and S.K. Barton, "Channel Estimation Using Aperiodic Binary Sequences", IEEE Transaction on Communication ,vol. 2, no. 5,May 1998, pp 140-142.

[8]. Jun Ma, Philip Orlik, Jin Zhang,Geoffrey Ye Li, "Pilot Matrix Design for Interim Channel Estimation in Two-Hop MIMO AF Relay Systems", IEEE International Conference on Communication (ICC), June 2009, pp. 234-240.

[9]. Matthias Stege, Marcus Bronzel & Gerhard Fettweis, " On the Performance of Time Block Codes", IEEE Transaction on Wireless Communication ,vol. 6, no.1, February 2001, pp. 2282-2286.

[10]. Mohinder Jankiram, "Space-Time codes and MIMO Systems" Universal Personal Communication Series, Edition 2004.

[11]. Siavash M. Alamouti, "A Simple Transmit diversity Technique for Wireless Communications", IEEE Journal on Select Areas in Communications, vol.16, no.8, October 1998, pp. 1451-1458

[12]. Jongsoo Choi, Martin Bouchard and Tet Hin Yeap ,"Adaptive Filtering-Based Iterative Channel Estimation for MIMO Wireless Communications", IEEE International Symposium on Circuits and Systems,vol.5, no. 2, May 2005, pp. 4951-4956.