

Frequency Aligned Space-Time Block Coded-OFDM for WLAN

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ABSTRACT

Recent advances in wireless communications promise increased data rates for wireless local area networks(WLAN). Space-time block code (STBC), especially Alamouti's scheme[1], which is combined with current OFDM WLAN system is considered for the diversity gain since STBC is a simple and elegant transmit diversity mechanism. On the indoor frequency selective channel, there are two combinations when we combine STBC and OFDM because STBC has a restriction about constant CSI(Channel state information) within two adjacent symbols. One is that STBC and OFDM are directly combined, and the other is that STBC coded symbols are aligned before OFDM processing. In this paper, we simulate two combinations on the indoor frequency selective and time varying channel and justify why the frequency aligner is required between STBC and OFDM.

I. Introduction

Recent advances in wireless communications promise increased data rates for wireless local area networks(WLAN). The major standards for WLAN have chosen orthogonal frequency division multiplexing (OFDM) in order to combat the frequency-selective fading channel.

New Task Group (TG) of IEEE, called 802.11n[2], was established in order to develop the next generation WLAN on September, 2003. The purpose of this TG are the increase the data rate over 100Mbps and the reduction of power consumption or the enhancement of bit error rate (BER) performance. [3][4]

Multi input multi output (MIMO) techniques provide improved signal to noise ratio(SNR) and BER performance and increase capacity compared to single antenna systems.[5][6]

Space-time block code (STBC), especially Alamouti's scheme[1], which is combined with current OFDM WLAN system is considered for the diversity gain since STBC is a simple and elegant transmit diversity mechanism. STBC cannot increase the data rate directly, but it can improve the network capacity by the diversity gain and the coverage range of an access point (AP)

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This paper is organized as follows : In

Section II, we described the STBC algorithm and the restriction of STBC about CSI. In Section III, the indoor channel model at 5GHz is presented. The direct combination of STBC-OFDM is described, and it is discussed the reason why the direct combination is not suitable in WLAN environment in Section IV. In Section V, frequency aligned STBC-OFDM is described. Simulation results are presented in Section VI. Finally Section VII concludes the paper.

II. SPACE-TIME BLOCK CODE

STBC schemes were originally proposed by Alamouti in [2] and Tarokh et al. in [3]. These schemes introduce a simple and elegant transmit diversity mechanism.

The space-time block code of Alamouti is constructed using orthogonal designs. In this chapter, we focus on a 2x2 code matrix.

This STBC uses the complex orthogonal code matrix

$$\begin{bmatrix} s_1 & -s_2^* \\ s_2 & s_1^* \end{bmatrix} \quad (1)$$

where the columns correspond to time and the rows to the transmit antenna.

If $|s_1|^2 + |s_2|^2 = 1$, all columns are orthogonal each other and all such code matrices are unitary. This scheme can achieve the full diversity gain NM.[7]