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Performance of Full Rate Non-Orthogonal STBC in Spatially Correlated MIMO Systems

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Abstract—Spatial correlation is a crucial impairment for practical Multiple Input Multiple Output (MIMO) wireless communication systems. It is important to consider spatial correlation between antennas in actual communication scenario at both sides, i.e. transmit and receive side. Furthermore, we have considered nonorthogonal full rate STBC in MIMO systems equipped with four transmit antennas and four receive antennas in a quasi-static Rayleigh fading channel. In this paper, Bit Error Rate (BER) performance of full rate non-orthogonal Space Time Block code (STBC) is obtained using simulations in MIMO wireless communication systems. Spatial correlation is assumed between antennas at both the transmitter and the receiver sides. For this analysis, we have considered various transmit antenna spacing values of $d_t = 0.1\pi$, 0.2π, and 0.4π keeping fixed $d_r = 0.1\pi$ and various receive antenna spacing values of $d_r = 0.1\pi$, 0.2π, and 0.4π keeping fixed $d_t = 0.1\pi$. The obtained results show that the transmitting diversity is more serious than the receiving diversity in the spatially correlated antenna environment for the specified signal-to-noise ratio. This study will be useful for actual wireless communication implementation where spatial correlation antennas are present in the practical environment of the MIMO wireless communication system.

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1. INTRODUCTION

Wireless communication in a fading channel is very challenging. The performance of wireless communication systems can be improved by using several diversity techniques and employing multiple antennas at the transmitter or at the receiver or at both the ends.

This is commonly known as multiple input multiple output (MIMO) and is reflected in many standards such as Long Term Evolution (LTE), Wideband Code Division Multiple Access (WCDMA) and the Worldwide Interoperability for Microwave Access (WiMAX).

In MIMO systems, at the transmitter, the space time block coding (STBC) is used to exploit diversity gain. A special case of Orthogonal STBC, the Alamouti space time code [1], which has been proposed for two transmit antennas, can offer full diversity gain, i.e. one. However, for more than two transmit antennas, the code rate is below one [2].

Recently, some non-orthogonal STBC have been proposed with reasonable decoding complexity and with a motivation to gain full diversity without loss of code rate [3, 4]. In [4], four transmit antennas were used and the BER performance was presented using simulations under assumption of spatially uncorrelated channels.

However, it is hardly possible to assume spatially non-correlated channels. Therefore, in this paper a real time scenario is considered assuming spatially correlated channels in MIMO system at both the ends [5–12]. Assuming coherent detection with QPSK modulation in quasi-static Rayleigh fading channels, we present the BER performance of this system and find that the effect of correlation at transmit antennas is more severe than that at receiver antennas.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

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