ISSN 0735-2727, Radioelectronics and Communications Systems, 2017, Vol. 60, No. 11, pp. 485–494. © Allerton Press, Inc., 2017.
Original Russian Text © V. Noor Mohammed, N. Srinatha, P.S. Mallick, L. Nithyanandan, 2017, published in Izvestiya Vysshikh Uchebnykh Zavedenii, Radioelektronika, 2017, Vol. 60, No. 11, pp. 628–639.

Interference Mitigation in Uplink STBC MC-CDMA System Based on PIC Receiver

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Received in final form September 5, 2017

Abstract—Multi Carrier Code Division Multiple Access (MC-CDMA) is attractive technique for high speed data transmission in multipath fading channel. MC-CDMA system cannot handle the sudden time variations of the channel which cause the subcarriers to lose their orthogonality. The loss of orthogonality between the subcarriers of a user or unwanted correlation between the spreading codes of different user can lead to increase in Multiple Access Interference (MAI). Space Time Block Code (STBC) based MC-CDMA system is chosen to achieve full diversity and transmission rate without the knowledge of Channel State Information (CSI) at the transmitter. Thus, in the paper STBC is introduced at the transmitter to improve the quality of the receiver. Space Time Block Code-Parallel Interference Cancellation (STBC-PIC) receiver has been proposed for MC-CDMA system. In the proposed STBC-PIC receiver, at each interference cancellation stage, weighted signal of the other user is subtracted from signal of the desired user, thereby reducing the MAI and improving the BER performance. From the simulation results, it is observed that the proposed receiver outperforms STBC-Orthogonal Complete Complementary Code (STBC-OCCC), STBC-Minimum Mean Square Error (STBC-MMSE) and STBC-Zero Forcing (STBC-ZF) receivers for MAI reduction.

DOI: 10.3103/S0735272717110036

1. INTRODUCTION

Multi Carrier Code Division Multiple Access (MC-CDMA) is one of the most promising multi carrier modulation techniques in 4G technology [1]. MC-CDMA is the combination of Orthogonal Frequency Division Multiplexing (OFDM) and CDMA. The merits of MC-CDMA include maximum utilization of spectrum, easy adjustment to strict channel conditions without complex detection, and high resistance to Inter Symbol Interference (ISI) and fading caused by multipath propagation [2]. This is attractive technique for high speed data transmission over multipath fading channel. It minimizes multipath effects such as Inter Symbol Interference (ISI) and Inter Carrier Interference (ICI) and improves the security [3].

This system cannot handle the sudden time variations of the channel since OFDM is involved in MC-CDMA system. The frequency and timing offset cause the subcarriers to lose their orthogonality [4]. The loss of orthogonality between the subcarriers of a user or unwanted correlation between the spreading codes of different user can lead to increase in Multiple Access Interference (MAI). The factors required for MAI reduction include the number of users and spreading sequence [2]. Current techniques have not achieved the reduction in MAI with less computational complexity and lower BER.

Space Time Block Code (STBC) based MC-CDMA system is adapted in wireless communication standards to achieve full diversity and transmission rate without the knowledge of Channel State Information (CSI) at the transmitter [5, 6]. STBC is introduced at the transmitter to improve the quality of the receiver.

This paper is organized as follows. Section 2 gives the detailed review of related work. Proposed STBC-PIC receiver for MC-CDMA system is described in section 3. The simulation results are analyzed in Section 4 followed by conclusion.

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