

短文与研究通讯

循环前缀块传输系统中的一种MIMO盲信道估计算法

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摘要:

信道估计一直是无线通信领域的研究热点之一, 信道参数估计的好坏对系统的整体性能有着至关重要的影响。针对采用循环前缀的多输入多输出(MIMO-CP)系统, 本文提出了一种基于子空间的盲信道估计方法, 该算法利用了循环前缀所引起的冗余信息。基于子空间的盲信道估计算法都是通过对接收块的自相关矩阵进行奇异值分解(SVD)来实现信道估计的, 因此需要利用尽可能多的接收块来得到准确的自相关矩阵的估计值, 这就意味着会产生过久的判决延迟以及不能准确对快变信道进行跟踪。利用MIMO-CP系统中系统矩阵特有的块循环特性, 对于连续的两个接收数据块以及对应的循环前缀部分组成的向量, 可以重新构造一组新的向量而不改变系统的信道矩阵, 因此可以通过较少的接收块来得到准确的自相关矩阵的估计值, 该方法十分适用于对快变信道的盲估计。文章通过仿真分析了在不同的重复系数以及不同的接收块下该算法的性能并且比较了该算法与现有的“预编码”、“虚拟子载波”等盲信道估计算法的性能。仿真结果表明, 提出的算法利用较少的数据块个数就得到了一个可靠的信道估计值和很好的误码率性能。

关键词: 多输入多输出; 盲信道估计; 循环前缀; 子空间

Blind channel estimation for MIMO systems with cyclic prefix

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Abstract:

Channel estimation is one of the key techniques in wireless communication systems, its accuracy has a significant impact on the overall system performance. This paper proposes a subspace based blind channel estimation algorithm for Multi-Input Multi-Output with cyclic prefix (MIMO-CP) systems, which utilizes the redundancy introduced by the cyclic prefix. The channels can be estimated by taking singular-value decomposition to the auto-correlation matrix of received blocks. It is essential to get an accurate the estimation of auto-correlation matrix by using the received blocks as more as possible. However, too many received blocks may cause a long detection delay, which would not be used in the real-time signal processing systems, and moreover, it is difficult to track the channels varying with rapid speeds. To overcome the disadvantages mentioned above, we proposed a subspace based blind channel estimation algorithm by using fewer blocks in the MIMO-CP systems, thus this method is very suitable for blind estimation of the fast varying channels. According to the unique property of the MIMO-CP systems, which the channel matrix is a block circulant channel matrix, for the vector composed of the two consecutive received data blocks and the corresponding cyclic prefix part, we can obtain a group of new vectors without changing the system matrix. By utilizing these extended vectors, we can get an accurate the estimation of auto-correlation matrix with fewer blocks. We discuss the complexity of the proposed method, which is proportional to the length of block, the channel order and repetition times. Considering the whole system performances, the increasing of the complexity of our method is acceptable. This paper analyzes the system performance in different repetition factors and the number of received blocks. Simulation results show that there is a compromising between the repetition times and the needed received blocks. Furthermore, compared with some existing methods, such as “precoding” and “virtual carriers” blind channel algorithms, the proposed algorithm archived a more reliable estimation and better bit error rate performance with fewer received blocks.

Keywords: MIMO Blind channel estimation cyclic prefix subspace

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