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短文与研究通讯

基于软判决的MMSE-OSIC接收机

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摘要：

串行干扰相消接收机是广泛应用于多输入多输出系统中的一种接收端信号处理与检测技术。在串行干扰相消接收机中,先检测的层的判决准确性会对后续层的检测产生影响。检测过程中产生的判决误差,将对后续层的检测引入残留干扰,进而影响后续层检测的正确性,造成差错传播。本文提出一种基于软判决的最小均方误差检测带排序串行干扰相消接收机,可以有效减轻基于硬判决方法的带排序串行干扰相消接收机的差错传播问题。在重构干扰信号时,该接收机使用根据软判决信息得到的符号期望,替代硬判决方法,能够有效降低干扰相消时各层之间由判决误差引起的残留干扰；该接收机还可以精确估计残留干扰的功率以及各层数据流的后处理信干噪比,改善了基于硬判决方法的串行干扰相消接收机存在的各层后处理信干噪比估计值偏大的问题。可靠性更高的软判决结果有效降低了残留干扰,更精确的各层后处理信干噪比抑制了残留干扰对后续数据流检测的影响,提高了判决结果和排序过程的准确性。仿真结果证明,基于软判决的最小均方误差检测带排序串行干扰相消接收机可以有效避免差错传播的产生,因而获得较大的性能提升。

关键词： 无线通信；多输入多输出系统；软判决；最小均方误差；串行干扰相消；对数似然比

MMSE-OSIC Receiver with Soft Decision

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Abstract:

The successive interference cancellation (SIC) receiver is widely used in the Multi-Input-Multi-Output (MIMO) system as a signal detection technology. In the SIC receiver, the decision error of the detected streams will impact the accuracy of the undetected streams, which will bring in residual multi-stream interference and cause the error diffusion problem. In this paper, a minimum mean square error-ordered successive interference cancellation (MMSE-OSIC) receiver with soft decision (SD) is presented. In the proposed SD-MMSE-OSIC receiver, the soft decision instead of the hard decision is used for interference regeneration and cancellation, which can efficiently prevent the error diffusion problem of the hard decision (HD) based MMSE OSIC receiver. We also propose a method to estimate the power of the residual multi-stream interference, with which we can accurately estimate the signal-to-interference-and-noise ratio (SINR) of each stream, which is usually overestimated in the HD based MMSE-OSIC receiver. In the proposed receiver, the soft decision method with higher reliability is utilized to minimize the residual multi-stream interference, while the accurate estimation of SINR helps to mitigate the impact of the residual interference on the undetected streams, thus fewer error diffusion problems are assured. Simulation results show that the proposed SD-MMSE-OSIC receiver significantly outperforms the linear MMSE receiver and the hard decision based MMSE-OSIC receiver.

Keywords: Wireless Communication MIMO Soft Decision MMSE SIC LLR

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