信号处理 2010, 26(3) 369-374 DOI: ISSN: 1003-0530 CN: 11-2406/TN

论文

4×4 V-BLAST系统分组最大似然检测算法

王海红, 王欣, 魏急波

国防科技大学电子科学与工程学院

摘要：

对于V-BLAST系统的检测，最大似然(ML)算法有着最优的性能却也有最大的计算复杂度；经典的排序连续干扰抵消(OSIC)算法复杂度较低，但数值稳定性差，且性能与ML差距较大。因此，本文基于检测性能和计算复杂度折中的思想，针对4×4 V-BLAST系统提出了一种分组最大似然(Group ML，GML)检测算法，在保证较好检测性能的基础上，通过将四维ML检测器分成两组二维ML检测器来降低计算复杂度。此外，本文还提出了一种简化的最大似然(Simplified ML，SML)检测算法，通过将每组中的二维ML检测器的搜索空间从二维降至一维，进一步降低了计算复杂度，并证明其与ML算法具有一致的性能。仿真表明，在误符号率为10^{-3}时GML算法相比OSIC算法有约7dB的性能提升。经分析知，GML算法复杂度与ML-OSIC算法相比在高阶调制方式下有着显著的降低，易于硬件实现。

关键词： V-BLAST 最大似然(ML) 分组最大似然(GML) 简化最大似然(SML)

Group Maximum Likelihood Detection Algorithm for a 4×4 V-BLAST System

WANG Hai-Hong, WANG Xin, WEI Ji-Bo

School of Electronic Science and Engineering， National University of Defense Technology， Changsha

Abstract:

Maximum likelihood(ML)algorithm not only has optimal performance but also has maximal computational complexity for detection of V-BLAST systems. Classical ordered successive interference cancellation (OSIC)algorithm has much lower complexity. However， it has a numerical value stability problem and has a largish performance gap by comparison to ML algorithm. Therefore， a group maximum likelihood (GML) algorithm is proposed for a 4×4 V-BLAST system in this paper， which is based on tradeoff between detection performance and computational complexity. On the basis of guarantee of preferable detection performance， it divides a four-dimension (4-D) ML detector into two 2-D ML detectors to reduce computational complexity. Moreover， a simplified maximum likelihood (SML) algorithm is also proposed to reduce further complexity by reducing the searching space of each 2-D ML detector from 2-D to 1-D. Simulations show that GML algorithm has about 7dB performance gain compared with OSIC algorithm at symbol error rate equals to 10^{-3}. After analysis， GML algorithm’s complexity reduces remarkably in large constellation modulation manner in comparison with that of ML-OSIC algorithm. This facilitates the hardware implementation.

Keywords: V-BLAST Maximum Likelihood(ML) Group ML(GML) Simplified ML(SML)

收稿日期 2009-01-08 修回日期 2009-09-10 网络版发布日期 2010-03-25

DOI:

基金项目:

通讯作者:

作者简介:

作者Email:

参考文献：

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