论文

Turbo-MIMO系统中一种基于部分后验概率的软检测算法

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Partial a Posteriori Probabilities Based Soft Detection for Turbo-MIMO Systems

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摘要 迭代树搜索(ITS)是一种有效的基于M-算法的软MIMO检测方案。然而ITS会遇到某些比特的对数似然比(LLR)无法确定的情况,虽可采用赋常数值方法(称为clipping)解决,但这会影响系统性能。为此,该文提出一种新的基于M-算法的软检测方案。该方案在树的每一级递推计算部分符号序列的后验概率,并基于此近似计算从第1级到该级的所有比特LLR,再采用M-算法保留部分符号序列延伸至下一级。该算法可确保每比特都可计算LLR,且能得到可靠性高的LLR值。考虑到某些比特LLR会多次计算,文中给出了算法的低复杂度实现。另外,该文还给出了一种计算符号序列后验概率的简单方法。最后,仿真结果表明所提算法相比ITS具有更好的性能,并使性能与复杂度达到较好的折中。

关键词: MIMO 软检测 M-算法 后验概率 比特对数似然比

Abstract: Iterative Tree Search (ITS) is an efficient M-algorithm based soft MIMO detection scheme. However, ITS often faces the problem that Log-Likelihood Ratio (LLR) values of some detected bits can not be evaluated. Although it can be somewhat solved by setting the LLR magnitude for these bits to a constant value—LLR clipping, the system performance would be degraded. To overcome this problem, this paper presents a new M-algorithm based soft detection scheme. The scheme recursively calculates the a posterior probabilities of partial symbol sequences at each stage of the tree, based on which the LLRs of those bits from the first stage to the current one are approximately computed,and then, by using M-algorithm, retains partial symbol sequences and extends them to the next stage. The scheme can ensure that the LLR of each bit can be calculated, and provide highly reliable LLRs. Considering that the LLRs of some bits may be evaluated several times, a reduced-complexity implementation method is given in the paper. In addition, the paper suggests a simple approach for calculating the a posterior probabilities of symbol sequences. Finally, simulation results show that the proposed algorithm can obtain better performance than ITS and achieve good performance-complexity trade-off.

Keywords: MIMO Soft detection M-algorithm A posterior probability Bit Log-Likelihood Ratio (LLR)

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