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论文

基于似然值概率密度演变的速率可变穿刺Turbo码的最优设计

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摘要
该文提出了一种新的用似然值概率密度演变来为高斯信道下的速率可变穿刺Turbo码(RCPT)选择最优穿刺矩阵的方法。这种新方法通过比较不同穿刺矩阵对应的解码门限来衡量Turbo码在低信噪比区域的性能。这种分析方法与传统的通过距离谱来分析Turbo码性能的方法相比主要有两个优点：一是这种新的分析方法与交织器无关，门限值不会随着交织器的变化而变化；二是在码字比较长的情况下，这种新的分析方法计算复杂度不会增加太多。计算机仿真结果表明，当码字比较长时，在高斯信道下，这种分析方法选出的最优穿刺矩阵与传统的距离谱分析方法选出的最优的穿刺矩阵是完全一致的。该文还进一步给出了以3G中的Turbo码为母码的最优RCPT矩阵以及其门限，并且发现当3G协议中的速率匹配采用穿刺的时候，速率匹配可以等效为一个穿刺矩阵。对于一些可以进行比较的速率，这个穿刺矩阵跟用该文提出的方法给出的最优穿刺矩阵是完全一致的。

关键词 编码 似然值概率密度演变 高斯近似 速率可变穿刺Turbo码(RCPT) 门限 3G 速率匹配

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Searching the Optimal Puncture Matrix for Rate Compatible Punctured Turbo (RCPT) Codes with Density Evolution

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Abstract
A new algorithm for searching the optimal puncture matrices of the rate compatible punctured Turbo(RCPT) codes is proposed. The algorithm is based on density evolution and its main goal is to analyze the thresholds for different puncture matrices. The thresholds are calculated using Gaussian approximation and simulation. Compared to a conventional distance spectrum approach, this new approach has two advantages. The first advantage is that the new algorithm is independent of the interleaver. The second is that when the Turbo code is very long, the complexity of the calculation will not increase too much for the proposed approach. In AWGN channels, when the code is long, the examples shows that the optimal puncture matrices are the same for both approaches while the proposed approach has reduced computational complexity. This paper also analyzes the puncture matrices of the code used in 3GPP and provides the optimal matrices and thresholds. The result shows that the rate matching algorithm given in 3GPP corresponds to some RCPT matrixes when using puncturing and these matrixes are the same as those optimal matrices given in this paper for certain rates.

Key words Code Density evolution Gaussian approximation Rate Compatible Punctured Turbo (RCPT) codes Threshold 3G Rate matching

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