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# 协作分集技术AF模式下反馈延迟随机性分析

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# Analysis of Randomness of Feedback Delay in CD-AF Wireless Networks

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**摘要** 该文采用一个三节点协作分集放大中继网络为研究模型。在Nakagami-*m*衰落信道条件下，对源节点发送一帧数据的反馈延迟的随机性进行了研究。数据帧在三节点协作网络中可以通过直接链路和中继链路到达目的节点，在物理层源节点根据信道条件不同，采用自适应调制编码技术，选择不同调制编码模式发送数据帧。结合以上原因，对数据帧的反馈延迟稳态分布进行研究。构造有限状态马尔科夫模型分析Nakagami-*m*信道的相关性，得到信道状态转移关系矩阵。推导出在研究模型中数据帧发送一次的反馈延迟的转移概率关系，经过仿真实验结果与数值分析结果的对比，验证了推导分析方法的准确性。最后分析信道衰落系数和物理层最大误帧率$P_{max}$对于反馈延迟概率分布的影响。

**关键词**： 无线通信 协作分集 自适应调制与编码 有限状态马尔科夫模型 反馈延迟 转移概率

Abstract: A three-node Amplify-and-Forward (AF) cooperative diversity network model is proposed in the paper. The randomness of feedback delay analysis is presented for the proposed model which the source transmits a frame over Nakagami-*m* fading channel. The frame can be transmitted from the direct link or relay link to the destination node. Additionally, Adaptive Modulation and Coding (AMC) technique is used in the source node of the analytical model which allows multi-rate transmission of the data frame, the transmitted mode is chosen according to the channel conditions. Based on the above reasons, the steady distribution of the feedback delay is analyzed, and a Finite State Markov Channel (FSMC) is developed to evaluate performance the Nakagami-*m* channel and obtain the channel state transition matrix. Then the transition probability of the feedback delay is derived. The simulative results are compared with the theoretic results, the results verify that the theoretic analysis is correct. Finally, the effect of channel fading coefficients and maximum frame error rate on the probability distribution of the feedback delay performance is analyzed.

Keywords: Wireless communication Cooperative Diversity (CD) Adaptive Modulation and Coding (AMC) Finite State Markov Channel (FSMC) Feedback delay Transition probability

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