电子与信息学报
JOURNAL OF ELECTRONICS & INFORMATION TECHNOLOGY

电子与信息学报 » 2011, Vol. 33 » Issue (7) :1525-1531 DOI: 10.3724/SP.J.1146.2010.01312

双向协作OFDM系统中基于能量定价的功率分配与中继选择算法

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Energy Pricing Based Power Allocation and Relay Selection Algorithm for Bidirectional Cooperative OFDM Systems

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摘要 该文研究双向两跳协作多中继正交频分复用(OFDM)系统的网络寿命优化问题。由于网络寿命最大化的问题无法直接求解，该文提出一种基于对各节点能量定价的次优算法，即将各子载波的功率分配，中继及源节点选择进行分步优化。首先利用拉格朗日法求解两个方向上的源与各中继节点配对时的最优功率分配，使得网络在满足一定吞吐量和发送功率限制的前提下，消耗能量总价值最小；然后在所有可能的配对中选择每个方向最优的中继节点；最后选择损耗能量价值较小的数据流方向。分别考虑了源与目的节点间有无直接链路两种场景，在有直接链路场景下分析了最大比值合并(MRC)和选择合并(SC)两种分集方式对功率优化的影响。仿真结果表明，该文提出算法的网络寿命比已有算法有显著提高。

关键词： 正交频分复用(OFDM) 功率分配 中继选择 协作通信 分集合并

Abstract： The network lifetime optimization issue is investigated for bidirectional two-hop cooperative Orthogonal Frequency Division Multiplexing (OFDM) systems recruiting multiple relays. Since direct treatment for the network lifetime maximization formulation is not feasible, a suboptimal strategy is proposed, which takes energy pricing concept for each node into account. Specifically, the power allocation for each subcarrier, relay, and source selection is optimized gradually rather than deriving jointly optimal solutions. Actually, by applying standard Lagrange technique, the optimal power assignment for each source/relay pair, which minimizes the total energy cost subject to limited transmission power and network throughput constraints, can be readily solved. An optimum relay is then selected out accordingly among all possible pairs, finally the direction of traffic flows can be determined by choosing the link with smaller price sacrifice. Two practical scenarios are considered, i.e., a direct source-destination link is available or not while implementing the proposal. Moreover, when the direct link can be fully exploited, the impact of two diversity combining techniques including Maximal Ratio Combining (MRC) and Selective Combining (SC) on the power allocation optimization is theoretically derived. Simulation results indicate that, the network lifetime by utilizing the proposed algorithm outperforms the existing approaches significantly.

Keywords： Orthogonal Frequency Division Multiplexing (OFDM) Power allocation Relay selection Cooperative communications Diversity combining

Received 2010-11-29;

本文基金:

国家自然科学基金(60702057)，国家杰出青年科学基金(60725105)，长江学者和创新团队发展计划(IRT0852)，综合业务网国家重点实验室基金(ISN1003002)和高校基础科研基金(JY10000901030)资助课题

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引用本文:

庞立华, 李建东, 张阳, 陈丹.双向协作OFDM系统中基于能量定价的功率分配与中继选择算法[J] 电子与信息学报, 2011,V33(7): 1525-1531

Pang Li-Hua, Li Jian-Dong, Zhang Yang, Chen Dan.Energy Pricing Based Power Allocation and Relay Selection Algorithm for Bidirectional Cooperative OFDM Systems[J] , 2011,V33(7): 1525-1531

链接本文:

http://jeit.ie.ac.cn/CN/10.3724/SP.J.1146.2010.01312 或 http://jeit.ie.ac.cn/CN/Y2011/V33/I7/1525