信号处理 2013, 29(12) 1660-1669 DOI: ISSN: 1003-0530 CN: 11-2406/TN

应用

多中继协作通信系统容量分析及中继选择协作分集策略

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摘要：

本文针对多中继辅助通信系统，将系统建模为一个两跳通信链路，并进行了系统容量分析。针对两种特殊情况：用户端接收噪声方差远小于中继端接收噪声方差和中继端接收噪声方差远小于用户端接收噪声方差的情况，本文具体给出了系统传输容量上限与协作中继个数之间的关系。基于容量的分析，本文设计了两种中继选择策略。在第一种情况下，根据中继与用户间的信道特征值对多路数据流分别选取不同的中继子信道进行传输；在第二种情况下，选择一个信道条件最好的中继完成多路数据流的并行传输。仿真分析表明，不同的信道环境需要选择不同的中继选择策略。

关键词： 系统容量；中继选择；协作通信；两跳通信系统

Capacity scaling of multi-relay channels and cooperative scheme based on relay selection

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Abstract:

The study on cooperative schemes has become an important component of future information technology research. A multi-relay channel is considered in this paper. Fixed relay stations are adopted here to help the transmission between the base and the users. The base-relay channel can be viewed as a broadcast channel (BC) and the relay-user channel can be viewed as a multiple-access channel (MAC). No direct link exists between the base and the user.

We investigate the capacity of this special multi-relay aided communication system. The relation between the capacity and the number of relays employed by the system is given. Then we generalize the study to two special cases: A. the noises at the relay stations are much greater than those at the user; B. the noises at the user are much greater than those at the relay stations. SVD decomposition is implemented at the base station and the user according to the equivalent channel response. The joint probability density of the eigenvalue of the equivalent signal-to-interference and noise ratio(SINR) is analyzed in this paper. The relation between the capacity and the number of relays employed by the system is detailed for that two cases mentioned above.

Some idiographic results are enumerated with mathematical analysis. For case A, we proposed to use a matrix which has an F-distribution to approximately describe the joint probability distribution of the equivalent channel matrix. We show that the corresponding capacity will decrease with the increase of the number of the relays. For case B, the joint probability distribution of the equivalent channel has a Wishart-distribution. The corresponding capacity will increase with the increase of the number of the relays. After mathematical analysis, numerical results are given. Simple and practical relay selection strategies are designed for different cases.

Keywords: system capacity relay selection cooperative transmission two-hop communication system

收稿日期 2013-06-07 修回日期 2013-09-04 网络版发布日期 2013-12-25

DOI:

基金项目:

国家自然科学基金(61201176)；国家自然科学基金（61071113）；“新一代宽带无线移动通信网”国家重大专项项目联合单位课题(2011ZX03003-003)

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