Title
Channel-Adaptive Frequency-Domain Relay Processing in Multicarrier Multihop Transmission Systems

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Introduction:

Multihop + Multicarrier

- Multihop: Dramatic power-saving by exploiting shorter propagation distances
- Multicarrier: Efficient bandwidth utilization
- Potential applications in both sensor networks and WiMAX-type of wireless networks

Intelligent signal processing at relay

- Relay adopts symbol-by-symbol processing w/o coding
  - Potential advantage in terms of latency
  - Adaptively optimized to exploit diversity in channel frequency responses

Problem Description:

How to design the relay given a multihop topology?

- Need to design power allocation scheme at both source and relay
- Need to design permutation pattern of sub-carriers at relay
  - A non-convex + combinatorial optimization problem
  - Exact optimal solution difficult to obtain

Proposed Solution:

Heuristic Solution: Greedy Scheme

- Water-filling for source-relay and relay-destination links, separately
- Rank end-to-end sub-carriers at relay according to channel gains
- Permutation pattern follows sub-carrier rankings

Numerical Results

- Substantially outperforms “dumb” amplify-and-forward
- Comparable with decode-and-forward without adaptive power allocation
- Acceptable gap to decode-and-forward with adaptive power allocation (optimal scheme achieving capacity)

Empirical CDF of rates:

Empirical CDF of percentage relative to decode-and-forward (capacity):

Simulation parameters: Number of sub-carriers = 128,
Source average power = 256 (w.r.t. noise var)
Relay average power = 128 (w.r.t. noise var)