Resource Allocation in OFDMA Cellular Networks

Project Code: CR3-08  
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Introduction:
OFDMA exploits frequency diversity and multi-user diversity, and it is the basic framework for the next generation wireless communication system design. Allocating subchannels, power within a cellular network is needed to enhance throughout with scarce resources. This project focuses on a multi-cell environment and considers the inter-cell-interference. We show that in a relay aided multi-cellular network, system performance can be largely improved.

Aims and Objectives
- study the use of digital fixed relay in cellular networks
- propose a heuristic low-complexity algorithm, which can be distributively implemented by each base station.

Use of Digital Fixed Relay
- Benefit of using relay: Transmission power saving  
  Inter cell interference reduction
- Optimal relay location: 2/3R

Methodology:
- Problem Formulation

\[
\begin{align*}
\text{Minimize} & \quad \sum_{i=1}^{K} \sum_{j=1}^{M} c_{ij} x_{ij} \\
\text{Subject to} & \quad \sum_{j=1}^{M} x_{ij} = 1, \quad \forall i \\
& \quad \sum_{i=1}^{K} x_{ij} = 1, \quad \forall j \\
& \quad x_{ij} \in \{0, 1\}, \quad \forall i, j
\end{align*}
\]

- Algorithm
Suboptimal solution with linear complexity, decoupled to 4 steps:
  - Routing
  - Subchannel Assignment
  - Power Allocation to each user

Simulation Results
- Converged Capacity and Effective Interference for different γ and fairness constraints
- Under different BS-RS link-cost
- Converged Capacity and Effective Interference under different user settings

Conclusion: Using relay can reduce inter cell interference and achieve higher capacity.

Conclusion: Need to search for the optimal threshold for interference under different BS-RS-link cost.

Conclusion: Relay-aided OFDMA system can better exploit multi-user diversity.