Journal Watch

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Joint Optimization Methods for Nonconvex Resource Allocation Problems of Decode-and-Forward Relay-Based OFDM Networks

Authors:Yaru Fu and Qi Zhu

Goal: To perform resource allocation in relay enhanced multi-carrier OFDM system.

Optimization problem

$$\max_{\{P_B, P_R, \rho\}} \sum_{i=1}^{I} \sum_{m=1}^{M} \sum_{k=1}^{K} w_k \rho_{m,k}(i) R_{m,k}^{B,R}(i)$$

$$s.t. C_1 : \sum_{i=1}^{I} \sum_{m=1}^{M} \sum_{k=1}^{K} \rho_{m,k}(i) p_{m,k}^{B}(i) \leq P_B^0$$

$$C_2 : \sum_{i=1}^{I} \sum_{k=1}^{K} \rho_{m,k}(i) p_{m,k}^{R}(i) \leq P_R^0 \quad \forall m$$

$$C_3 : R(k) \geq R_k \quad \forall k$$

$$C_4 : \sum_{m=1}^{M} \sum_{k=1}^{K} \rho_{m,k}(i) \leq 1$$

$$C_{5,6,7} : \rho_{m,k}(i) = \{0, 1\}, p_{m,k}^{B}(i), p_{m,k}^{R}(i) \geq 0$$

Issues

- Combinatorial
- Non-convex constraint

Solution

- Integer constraint $\rightarrow$ Box constraint
- Non-convex constraint: Solve for new variable $\hat{p}_{m,k}^{B}(i) = \rho_{m,k}(i) p_{m,k}^{B}$
- Express C_3 in terms of new variable

$\Downarrow$

Lagrangian Dual Problem

$\Downarrow$

$$(\tilde{m}, \tilde{k}) = \max w_k \tilde{\rho}_{m,k}(i) Q(\tilde{\rho}_{m,k}(i))$$

$$s.t. \quad \rho_{m,k}(i) = \{0, 1\}$$

Maximizing Mobile Coverage via Optimal Deployment of Base Station and Relays

Authors: Xu Li, Dongning Guo, John Grosspietsch, Huarui Yin, Guo Wei

Goal: Maximize reach by optimizing BS and RSs location.

Case 1: Deployment of relays

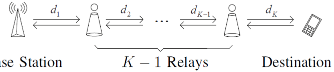


Fig. 1. Network model with relays.

$$\max_{\{D,T,S,\gamma,\tau\}} \sum_{k=1}^{K} d_k$$

s.t. Outage probability (P_o)

or Data rate requirement (Γ_k)

Propositions:

- $D_{\max}$ with P_o: $D_{\max} \uparrow$ with $\uparrow$ in RS
- $D_{\max}$ with Γ_k: No improvement beyond certain no. of RS

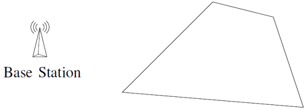


Fig. 2. Network model with a base station.

Case 2: Deployment of Base Station

$$\min_{\{r,x,y\}} \quad r^2$$

$$s.t. \quad (x - x_i)^2 + (y - y_i)^2 \leq r^2, \forall i$$

$$(x, y) \neq \mathcal{I}$$

- Without Placement Restriction
- With Placement Restriction

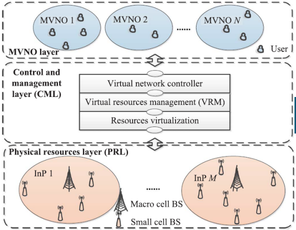
Distributed Virtual Resource Allocation in Small-Cell Networks With Full-Duplex Self-Backhauls and Virtualization

Authors: Lei Chen, F. Richard Yu, Hong Ji, Gang Liu, and Victor C. M. Leung

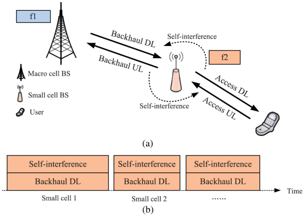
Main Feature

- Wireless virtualization
- Self-backhauling based on FD Communication

System Model:



Virtualized Small Cell Architecture



Self-backhauling Mechanism

Utility Function

$$G_{MVNO}$$

$$\Downarrow$$

$$\sum_{m \in \mathcal{M}} \{\sum_{u \in \mathcal{U}} \delta_u C_u^m\} - \gamma T_i^m - Q_i^m$$

Virtual RA Problem

$$\max_{\{X,Y,Z,\alpha\}} \sum_{i=1}^{N} G_{MVNO_i}$$

$s.t.$ C_1 : Throughput

C_{2-3} : Indicator 1

C_{4-8} : Indicator 2-4

Issues

- Non-convex
- Combinatorial

Solved using ADMM

Fix α, Solve for X,Y,Z

$\Downarrow \quad \Uparrow$

Fix X,Y,Z, Solve for α

Information and Energy Cooperation in OFDM Relaying: Protocols and Optimization

Authors: Yuan Liu and XiaodongWang

Goal: Maximize throughput by jointly allocating power, subcarriers and transmission modes.

Joint Optimization Problem

$$\max_{\{P,Y\}} \quad R_{TMA}$$

$$s.t. C_1 : \sum_{n\in\mathcal{N}} p_{r,n} \leq \sum_{n\in\mathcal{N}} y_{d,n} p_{sd,n} h_n$$

$$C_2 : \sum_{n\in\mathcal{N}} (y_{c,n} p_{sr,n} + y_{d,n} p_{sd,n}) \leq P$$

$$C_3 : y_{c,n} + y_{d,n} \leq 1 \forall n$$

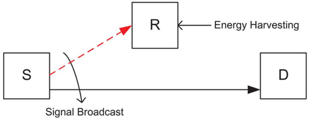
$$C_4 : 0 \leq p_{sr,n} \leq P_n^{\max}$$

$$C_5 : 0 \leq p_{sd,n} \leq P_n^{\max}$$

$$C_6 : 0 \leq p_{r,n} \leq P_n^{\max}$$

$$C_7 : y_{c,n}, y_{d,n} \in \{0, 1\}$$

Mode Adaptation Protocol



(b)

Solution

- Integer constraint $\rightarrow$ Box constraint
- Non-convex constraint: Solve for new variable
- Solved it using Lagrange Dual function