Journal Watch - 4 June 2016

IEEE Transactions on Wireless Communications
Issue - May 2016

Per-Relay Power Minimization for Multi-user Multi-Channel Cooperative Relay Beamforming.
–A. R. Kebrya, M. Dong, B. Liang, G. Boudreau, R. Casselman

- Optimal relay beamforming problem for multi-user peer-to-peer communication with amplify-forward relaying in multi-channel system: Formulated as min-max per-relay power minimization with minimum SNR guarantees.

- **Model:** Two-hop wireless AF system.
$$r_m = \sqrt{P_0}\mathbf{g}_m^T\mathbf{W}_m\mathbf{h}_m s_m + \mathbf{g}_m^T\mathbf{W}_m\mathbf{n}_{r,m} + n_{d,m}$$
$$\mathrm{SNR}_m = \frac{P_0\mathbf{w}_m^H\mathbf{F}_m\mathbf{w}_m}{\sigma_d^2 + \mathbf{w}_m^H\mathbf{G}_m\mathbf{w}_m}; \ \mathbf{F}_m = \mathbf{g}_m \odot \mathbf{h}_m, \ \mathbf{G}_m = \mathrm{diag}(\mathbf{g}_m\mathbf{g}_m^H)$$
$$P_{r,i} = \sum_{m=1}^{M} \mathbb{E}[|w_{m,i}y_{m,i}|^2]$$

-

$$\min_{\{\mathbf{w}_m\}} \max_{1 \le i \le N} P_{r,i}$$
$$\mathrm{s.t.} \frac{P_0\mathbf{w}_m^H\mathbf{F}_m\mathbf{w}_m}{\sigma_d^2 + \mathbf{w}_m^H\mathbf{G}_m\mathbf{w}_m} \ge \gamma_m, \ m = 1, 2, \ldots, M.$$

Per-Relay Power Minimization for Multi-user Multi-Channel Cooperative Relay Beamforming.   -A. R. Kebrya, M. Dong, B. Liang, G. Boudreau, R. Casselman

- Solution can be obtained in the dual domain; dual problem converted to SDP through transformations. (The per-relay power minimization problem has zero duality gap).

- Optimal relay beamforming solution can be obtained in three cases depending on the values of the optimal dual variables. Cases correspond to whether the minimum SNR requirement is met at each S-D pair with equality and whether the power consumption at a relay is maximum.

- The reverse problem of max-min SNR subject to per-relay power constraints is also studied. Inverse relation between the two problems is shown and an iterative bisection algorithm to solve the max-min SNR problem is proposed.

- It is shown that the optimal max received SNR is a strictly monotonically increasing function of the optimal objective of first problem.
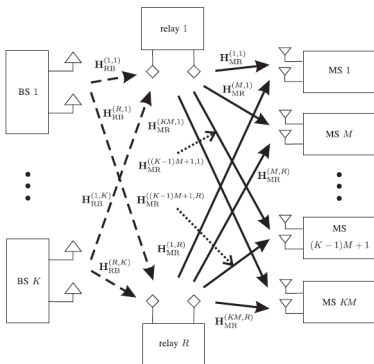
Maximizing the Sum Rate in Cellular Networks Using Multiconvex Optimization.

–H. Al-Shatri, X. Li, R. S. Ganesan, A. Klein, T. Weber

- Maximize the sum-rate in interference-limited scenarios - multi-convex problem.
- Estimated data symbol: $\hat{d}^{(m)} =$
  $\mathbf{u}^{(m)H}\left(\sum_{k=1}^{K}\sum_{r=1}^{R}\mathbf{H}_{MR}^{(m,r)}\mathbf{G}^{(r)}\mathbf{H}_{RB}^{(r,k)}\mathbf{V}^{(k)}\mathbf{d}^{(k)} + \sum_{r=1}^{R}\mathbf{H}_{MR}^{(m,r)}\mathbf{G}^{(r)}\mathbf{n}_{R}^{r} + \mathbf{n}_{M}^{m}\right)$


- Received SINR at mth MS $=$
  $\dfrac{P_d|\mathbf{u}^{(m)H}\mathbf{q}^{(m)}|^2}{\mathbb{E}\{|\mathbf{u}^{(m)H}\mathbf{z}^{(m)}|^2\}}$
  $\mathbf{q}^{(m)} = \sum_{r=1}^{R}\mathbf{H}_{MR}^{(m,r)}\mathbf{G}^{(r)}\mathbf{H}_{RB}^{(r,k)}\mathbf{v}^{(k,m)}$

- Idea - replace the SINR term with a term whose max. value is $1+$SINR.

- Multiconvex function - There exists a partitioning of the set of variables into disjoint non-empty subsets such that the function is convex for each of these subsets.

Elliptical Lagrange-Based NLOS Tracking Localization Scheme.

–S. W. Chen, C. K. Seow, S. Y. Tan
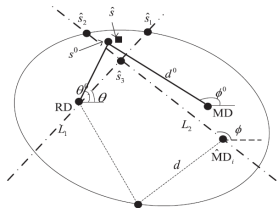
- Tracking localization scheme that requires only a single dominant NLOS and its scattering point - uses elliptical Lagrange-constrained function.

- Model: $\theta = \theta_0 + n_\theta$; $\phi = \phi_0 + n_\phi$; From the TOA, measured distance $d = d_0 + n_d$.
  Locus of scattering point is an ellipse with major axis length d.

- Error variance derived and compared with CRLB.

Wireless Power Meets Energy Harvesting: A Joint Energy Allocation Approach in OFDM-Based System.

-X. Zhou, C. K. Ho, R. Zhang

- User harvests energy from EAP to power information transfer to DAP. Objective - maximize the achievable rate at the DAP by joint optimization of SC allocation and power allocation over time for both WET and WIT links.

- Under full CSI, it is shown that the optimal solution satisfies:
    - WET occurs on at most one SC.
    - WET can occur only in a slot that has a larger channel gain than previous slots.
    - If $B_1 = 0$, optimal power allocation performs SWF over slots.

- Problem:

$$\max_{\{N_k^E\}, \{q_{k,n}\}, \{p_{k,n}\}} \frac{1}{KN} \sum_{k=1}^{K} \sum_{n \in N_k^E} \log_2(1 + \frac{g_{k,n} p_{k,n}}{\Gamma \sigma^2})$$

$$\text{s.t.} \frac{1}{K} \sum_{k=1}^{K} \sum_{n \in N_k^E} q_{k,n} \leq Q$$

$$\sum_{k=1}^{i} \sum_{n \in N_k^E} p_{k,n} \leq \zeta \sum_{k=1}^{i-1} \sum_{n \in N_k^E} h_{k,n} q_{k,n} + B_1, i \in \mathcal{K}$$

Wireless Power Meets Energy Harvesting: A Joint Energy Allocation Approach in OFDM-Based System.

-X. Zhou, C. K. Ho, R. Zhang

- Given full CSI, problem is solved in two stages [Offline algorithm]:
  - Given SC allocation, optimal joint power allocation over time and SCs for WET and WIT.
  - Two heuristic schemes for the SC allocation - dynamic and static SC allocation.

- Given causal CSI, online scheme - dynamic SC with observe-then-transmit.

Other interesting papers

- Optimal Quality-of-Service Scheduling for Energy-Harvesting Powered Wireless Communications.
  - Xiaojing Chen, Wei Ni, Xin Wang, and Yichuang Sun

- Tradeoff Analysis and Joint Optimization of Link-Layer Energy Efficiency and Effective Capacity Toward Green Communications.
  - Wenjuan Yu, Leila Musavian, and Qiang Ni

- Joint Power and Admission Control for Spectral and Energy Efficiency Maximization in Heterogeneous OFDMA Networks.
  - Wei-Sheng Lai, Tsung-Hui Chang, and Ta-Sung Lee

- An Optimal Power Control Algorithm for STDMA MAC Protocols in Multihop Wireless Networks.
  - Siqian Cui, Homayoun Yousefi'zadeh, and Xuemai Gu