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Device-to-Device Millimeter Wave Communications: Interference, Coverage, Rate and Finite Topologies

-Kiran Venugopal, Matthew C.Valenti and Robert W.Heath

Aim

Use stochastic geometry to analyze the performance of mmWave networks with finite number of interferers in a finite network region

Contribution

Accurate expressions for coverage and rate which capture the antenna characteristics like directivity and gain

System model

- All interferers are on the same horizontal plane as the reference receiver
- Model human body blockages , i^{th} user associated with transmitter X_i and blockage B_i
- Different channel parameters for LOS and NLOS
- For all transmitters find the blockages within a distance $W/2$, where W is the diameter associated with any blockage. Compute blocking cones for the transmitters
- Coverage probability $P_c(\beta, \Omega) = Pr\{\gamma > \beta|\Omega\}$
- Ergodic spectral efficiency, $P_\eta(\eta, \Omega) = P_c(2^\eta - 1, \Omega)$

Assumptions

- Locations of interferers and blockages related by orbital model
- Locations of interferers and blockages drawn from independent point processes
- Blockage states of interferers are independent
- Interferers beyond some distance are NLOS

Approach

- Evaluate CCDF of SINR and spectral efficiency
- Obtain expressions for coverage probability conditioned on the location of interferers and blockages
- Find spatially averaged coverage and rate when interferers and blockages are drawn from a random point process under simplifying assumptions

Optimum Transmission Policies for Energy Harvesting Sensor Networks Powered by a Mobile Control Center

–Tao Li, Pingyi Fan, Zhengchuan Chen and Khaled Ben Letaief

Contribution

- Closed form expression for optimal transmission policy
- Transmission policy under the constraint of fixed information rate

System Model

- Mobile central controller collects information from sensor nodes and powers the sensor nodes, which have no other energy source
- No interference between sensors
- Harvest-use and harvest-store-use scheme

Approach

- Simple optimization problem using Lagrangian to calculate the transmit power of the central controller
- Claims novelty in reducing harvest-store-use to harvest-use
- Virtual energy transmitter to the sensor node with a delay(corresponds to the storage)
- Optimal policy aims at cumulative throughput maximization

Content-Centric Sparse Multicast Beamforming for Cache-Enabled Cloud RAN

–Meixia Tao, Erkai Chen, Hao Zhou and Wei Yu

Motivation

- Congestion free, content aware, fast data transfer
- Efficient capacity offloading approach for common content delivery to multiple subscribers on the same resource block

System model

- All BSs connected to central processor via backhaul links
- Each user served by a cluster of cache enabled BSs
- BS clustering matrix $S \in \{0,1\}^{MxN}$
- Network wide beamforming vector of multicast group m, $\mathbf{w}_{m,n} \in \mathbb{C}^{NLx1}$, sparse in nature
- Cache placement matrix $C \in \{0,1\}^{FxN}$
- Total network cost, $C_N = C_B + \eta C_P$

Approach

- Find BS clusters
- Replace backhaul cost with l_0 norm of antenna beamforming vector
- Apply log/exp/arctan smoothing functions
- Solve using DC and CCP techniques

Optimization problem

$$min_{\{w_{m,n}\},\{s_{m,n}\}} \sum_{m=1}^{M} \sum_{n=1}^{N} s_{m,n}(1 - c_{f_{m,n}})R_m + \eta \sum_{m=1}^{M} \sum_{n=1}^{N} \|w_{m,n}\|^2$$

$$s.t. \; SINR_k \geq \gamma_m, \forall \; k \in G_m, \forall \; m$$

$$s_{m,n} \in 0, 1, \forall \; m, n$$

$$(1 - s_{m,n})\mathbf{w}_{m,n} = \mathbf{0}, \forall \; m, n$$

Other interesting papers

- Seunghwan Kim and Alenka Zajic,"Statistical Modeling and Simulation of Short-Range Device-to-Device Communication Channels at Sub-THz Frequencies".
- Goran T.Djordjevic, Kimmo Kansanen and Aleksandra M.Cvetkovic,"Outage Performance of Decode-and-Forward Cooperative Networks Over Nakagami-m Fading With Node Blockage".
- Talha Ahmed Khan and Ahmed Alkhateeb, "Millimeter Wave Energy Harvesting".