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The Device-to-Device Reuse Maximization Problem With Power Control

–Markus Klügel and Wolfgang Kellerer

Aim

Find the largest set of links that can achieve their SINR constraints inspite of mutual interference

Problem Formulation

SINR constraint of the link i:

$$\Gamma_i(\bar{P}) = \frac{h_{ii} P_i}{\sum_{j \neq i} h_{ij} P_j + N_i} \geq \gamma_i, \quad \forall i \tag{1}$$

Relaxed-RMP (interference limited):

$$\begin{aligned} &\max_{\bar{\alpha}, \bar{P}} \sum_{i \in \mathcal{L}} \alpha_i \\ &s.t. \bar{P} \geq \Lambda(\bar{\alpha}) \mathbb{F} \bar{P} \ ; \ \bar{P} \in \mathcal{P} \ ; \ \bar{\alpha} \in [0,1]^N \end{aligned} \tag{2}$$

$\Lambda(\bar{\alpha}) = diag\{\alpha_1, \ldots, \alpha_N\}$; $\mathbb{F}$ is the relative gain matrix, $[\mathbb{F}]_{ij} = \gamma_i \frac{h_{ij}}{h_{ii}}$, if $i \neq j$ and 0 otherwise

- The inequation $\bar{P} \geq \Lambda(\bar{\alpha}) \mathbb{F} \bar{P}$ is satisfied iff $\rho(\Lambda(\bar{\alpha})\mathbb{F}) \leq 1$

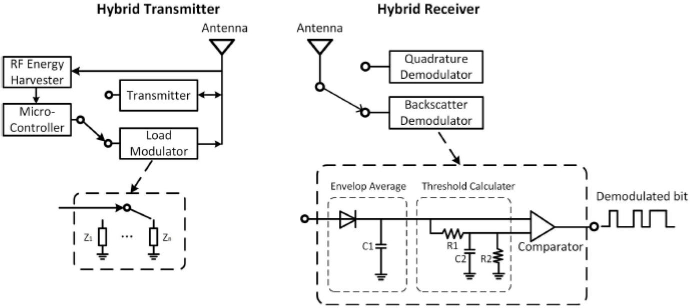
- Define interference load, $\bar{I}_\rho = \Lambda(\bar{\alpha})\mathbb{F}\bar{P}_\rho$
  interference spillage, $(\Lambda(\bar{\alpha})\mathbb{F})^T \bar{s}_\rho = \bar{s}_\rho \rho_{\bar{\alpha}}$
- Relative interference pressure of link i: $m_i = s_{\rho,i} I_{\rho,i}$
- Worst pressure shutdown algorithm: successively deactivate the link with largest interference pressure
- $\tilde{\epsilon}$-pressure packing algorithm: inactive devices reduce the SINR target by $\tilde{\epsilon}$dB instead of completely shutting down

Wireless-Powered Device-to-Device Communications With Ambient Backscattering: Performance Modeling and Analysis

–Xiao Lu, Hai Jiang, Dusit Niyato, Dong In Kim and Zhu Han

Contributions

- Introduce hybrid D2D communication by integrating ambient backscattering with wireless-powered communications
- Two mode selection protocols based on power and SNR
- Performance metrics: energy outage probability, coverage probability and average throughput



- Power threshold based protocol (PTP): $P_E^H \leq \rho_H \Rightarrow$ ambient backscatter mode
- SNR threshold based protocol (STP): $\nu_B > \tau_B \Rightarrow$ ambient backscatter mode
- The ambient transmitters in the vicinity of the hybrid Tx and hybrid Rx are modeled using α-Ginibre Point Processes. α indicates the repulsion degree of the spatial points

Overall energy outage probability:

$$\mathcal{O} = \mathcal{B}\mathbf{P}[P_E^B \leq \rho_{\mathcal{B}}] + (1-\mathcal{B})\mathbf{P}[P_E^H \leq \rho_H] \quad (3)$$

ρ_B and ρ_H: circuit power consumption rates in ambient backscatter and HTT modes, resp.

Conclusions

- Self sustainable D2D communications benefit from larger repulsion, transmission load and density of ambient energy sources
- PTP suitable when density of ambient sources is large and interference is low
- STP suitable when density and interference are both low or both high

Wireless Information and Power Transfer: Rate-Energy Tradeoff for Nonlinear Energy Harvesting

–Jae-Mo Kang , Il-Min Kim and Dong In Kim

- Hardware does not support simultaneous energy harvesting and info decoding
- Come up with receiver design to achieve best possible R-E performance

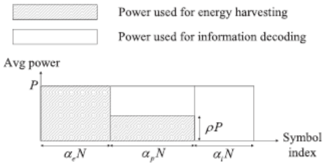


Figure: Generalized On-Off Power Splitting

- RF signal during k^{th} symb. is split with ρ_k

- Non-linear energy harvesting model:

$$E_{NL}(\rho_k) = \frac{P_s[\psi(\rho_k) - \Omega]}{1 - \Omega} \quad (4)$$

$$\psi(\rho_k) = \frac{1}{1+\exp(-A(\rho_k hP - B))}$$

- Channel capacity for the k^{th} info symbol:

$$C(\rho_k) = \log_2\left(1 + \frac{(1-\rho_k)hP}{(1-\rho_k)\sigma_{ant}^2 + \sigma_{cov}^2}\right) \quad (5)$$

- R-E region of GOPS:

$$\mathcal{C} = \cup_{\alpha,\rho}\{(R,Q) : Q \le \alpha_e E_{NL}(1) + \alpha_p E_{NL}(\rho), \; R \le \alpha_p C(\rho) + \alpha_i C(0)\}$$

Other interesting papers

- Mohammad Moltafet, Paeiz Azmi, Nader Mokari, Mohammad Reza Javan, and Ali Mokdad, "Optimal and Fair Energy Efficient Resource Allocation for Energy Harvesting-Enabled-PD-NOMA-Based HetNets"
- Qingqing Wu, Yong Zeng, and Rui Zhang, "Joint Trajectory and Communication Design for Multi-UAV Enabled Wireless Networks"
- Xuening Liao, Yuanyu Zhang, Zhenqiang Wu, Yulong Shen, Xiaohong Jiang, and Hiroshi Inamura, "On Security-Delay Trade-Off in Two-Hop Wireless Networks With Buffer-Aided Relay Selection"
- Niranjan M. Gowda and Ashutosh Sabharwal, "JointNull: Combining Partial Analog Cancellation With Transmit Beamforming for Large-Antenna Full-Duplex Wireless Systems"