Design of Dual Energy Harvesting Communication Links with Retransmission

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System Model

Battery Evolution and Outage

- Tx battery evolution $B_{t+1} = \min(B^*_{tx} + E_s - L_1 E_s, B^*_{cap})$, with prob. $\rho_t$
- ARQ: $P_{out} = \Pr[\gamma(t) < \gamma_0] = \Pr[|P_i - |h_i|^2 < \gamma_0]$
- HARQ-CC: $P_{out} = \Pr[\gamma(t, \text{dc}) < \gamma_0] = \Pr[\sum_{i=1}^n |P_i - |h_i|^2 < \gamma_0]$

Goals

- To analyze the packet drop probability
- To find the optimal control policies which minimize the PDP

Packet Drop Probability

$P_{b} = \sum_{i,j \in L} \pi(i,j) P_{b}(K|i)$

Optimal Policy Design

- $P_{b} \rightarrow P_{b}^*$ as $\Theta(e^{t/B_{cap}}) + \Theta(e^{t/B_{out}})$
- In EUR the PDP can be approximated as $P_{b}^*$
- Solve the simplified optimization problem using geometric programming

Results and Summary

- For sufficiently large batteries it is nearly-optimal to design policies under average power constraint
- Battery size required to obtain desired performance also depends on the drift induced by the policy
- Designed RIPs outperforms the policies obtained using MDPs

Figure: Battery Size

Figure: Proposed Policy Compared to MDP