Paranoid Secondary: Power Control for a Bursty Cognitive Interference Channel
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**MOTIVATION**

- Underutilized spectrum
- Rate margin due to burstiness of data
- Interference margin due to channel
- Compatibility with legacy systems

**Aim:** To maximize the secondary rate while satisfying the interference and average power constraints.

**Channel Model:**

- $\mathcal{N}(0,1)$

- Tx 1 (Fixed Primary)
- Rx 1

- Tx 2 (Cognitive)
- Rx 2

**BLOCK SWITCHING MODEL**

- $B_1$
- $B_2$
- $B_3$

- $t$

**Primary Model:**

- Fixed decoder and interference margin
- Bursty traffic – one state switch per block

$$R_1 = C \left( \frac{\text{SNR}_1}{1 + \text{INR}_{\text{gap}}} \right)$$

**Effective secondary channel:**

$$Y_2^{(t)} = X_2^{(t)} + Z_2^{(t)}$$

$$Z_2^{(t)} = \begin{cases} 
\mathcal{N}(0,1) & \text{if } s_2 = 0 \\
\mathcal{N}(0,1 + \sqrt{\text{INR}_2}) & \text{if } s_2 = 1 
\end{cases}$$

**Scheme: SENSE and SEND**

Sense at the beginning of each block and then send

**No-sensing scheme:**

- Treat primary as noise ($x_1.S$)
- Decode off primary and eliminate interference ($x_1.0$)
- Do both (mixture codeword)

**Genie-aided sensing scheme:**

- When primary is off send ($x_0$)
- When primary is on use a mixture codeword ($x_1.S$)

**Tightness of Bounds**

Less burstiness implies less to make use of a genie-aided scheme.

**CONCLUSION**

- Performance of no-sensing, genie-aided sensing and perfect sensing
- Multiplexed codewords achieve capacity
- Mixture codewords (N+SIC)
- When channel utilization is small, there is no gain in sensing
- For lower channel utilization all the schemes are equally good