High speed power line communications require the design of advanced modulation techniques and the use of statistically representative channel models. We have developed adaptive filtered multi-tone (FMT) modulation and orthogonal frequency division multiplexing (OFDM) schemes. We have also implemented two channel simulators based on a top-down or a bottom-up statistical approach.

### Abstract

The achievable rate (AR) is a function of the CP duration

\[ C(\mu) = \frac{1}{(M + \mu)T} \sum_{k=0}^{M} (1 + \text{SNR}(\mu)) \]

The optimal CP is obtained maximizing the AR, i.e.,

\[ \mu^{\text{opt}} = \arg\max_{\mu} C(\mu) \]

To lower the complexity we propose to adapt over a small set of CP values. For each channel class we have found a near optimal CP value studying the statistic of the optimal CP.

- Filtered Multi-Tone (FMT) achieves higher rate than Pulse-Shaped OFDM (PS-OFDM)
- The lower the SNR the higher is the advantage of FMT w.r.t. PS-OFDM
- FMT has a better notchting capability w.r.t. PS-OFDM
- FMT achieves the maximum rate with a smaller number of tones

- Obtained introducing variability into the Dostert Zimmerman multipath propagation model
- Analytical formulation of the Power Line Channel Transfer Function
- It can generate channels belonging to several classes of capacity (3 shown in the plot) consistent with measurements
- Fast and straightforward channel generation
- Low computational effort

### Statistical Top-Down Channel Model

- It keeps all the topological information about generated channels
- Cable types and interconnection structures
- Outlets and loads arrangement
- Novel channel classifications and studies based on nodes location
- Intercluster and intracluster classes

### Statistical Bottom-Up Channel Model

- Novel Random Topology Generation Algorithm
- Efficient Bottom-up Channel Transfer Function Computation

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