Principles of Unique Word OFDM

1) pick value k to interpolate, with highest noise variance (diag of C_ee)
2) update noise statistics C_ee
3) return to 1
Choice of samples to interpolate and from which to interpolate is crucial for the performance.

Non-Systematic Symbol Generation

F_N^{-1}BA\begin{bmatrix} 1 \\ T \end{bmatrix} = \begin{bmatrix} x_d \\ 0 \end{bmatrix}

Goal: Find A to minimize trace of Cee after LMMSE estimation in an AWGN channel.
For fixed c, the cost function reads
\[ J = \sigma_\lambda^2 \left\{ \left( \frac{N_d}{c^2 + G^2} G^2 + I \right) \right\} \Rightarrow G = \arg\min(J) \]

Different initializations:
\[ A^{(0)} = P \]
\[ A^{(0)} = \text{rand}(N_d, N_d) \]

Procedure as follows:
- assemble UW-OFDM symbol
- transmit over multi-path channel
- transform into frequency domain
- remove zero subcarriers and UW influence

\[ \tilde{y} = HGd + \tilde{n} \]

=> linear model

Apply sophisticated linear and non-linear data detection methods.

LMMSE estimation
\[ \tilde{d} = (C_{ee}^*H^*G + \frac{N_d}{c^2} G^2)^{-1} C_{ee}^*H^*y \]

Sphere Decoding
QR decomposition

[Diagram of sphere decoding]

Noise Interpolation
Use LMMSE estimate and error statistics to interpolate picked error values

C_{ee} = \hat{C}_{ee}^* \hat{H} \hat{G} \hat{d} - \hat{y}^T \hat{y}

Successive Interference Cancellation

SD
Soft information by LLRs using the max-log approximation

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