Iterative MMSE Beamforming – Accomplished via simple LMS/RLS algorithm and training sequences (as in 802.11b/g.)

\[
\begin{align*}
\mathbf{w}_1(m + 1) &= \mathbf{R}_1(\mathbf{g}^n_{-i})^{-1}\mathbf{H}_{1,l(1)}\mathbf{g}_{l(1)}(m + 1) \\
\mathbf{g}_1(m + 1) &= \mathbf{w}_1^*(m + 1)/||\mathbf{w}_1(m + 1)||
\end{align*}
\]

Equivalent to Power Algorithm.
Main Results

• Weak Duality – Replace receive transmit beamformer pair \((w_i, g_i)\) at all nodes by \((g_i^*, w_i^*)\), minimum sum power remains unchanged – Does not imply that optimum \(g_i = w_i^*\).
• IMMSE Beamforming is a non-cooperative game.
• Utility function maximizes normalized SNR to meet target SNR at all nodes with minimum power. Includes tax proportional to interference to other nodes.
• Fixed point of the IMMSE algorithm exists. Convergence has been proven for a modified game with rank-1 channels based on Total Interference Function (TIF).
Example of Fixed-Point and Power Efficiency of IMMSE

\[ M_r = M_t = 8 \]
\[ \gamma_0 = 10 \]