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Adaptive Zero Forcing Equalization to Compensate Multipath Fading Effect

In this study, the performance of the adaptive zero forcing channel equalizer algorithm was tested using known training sequence and finite length equalizer.

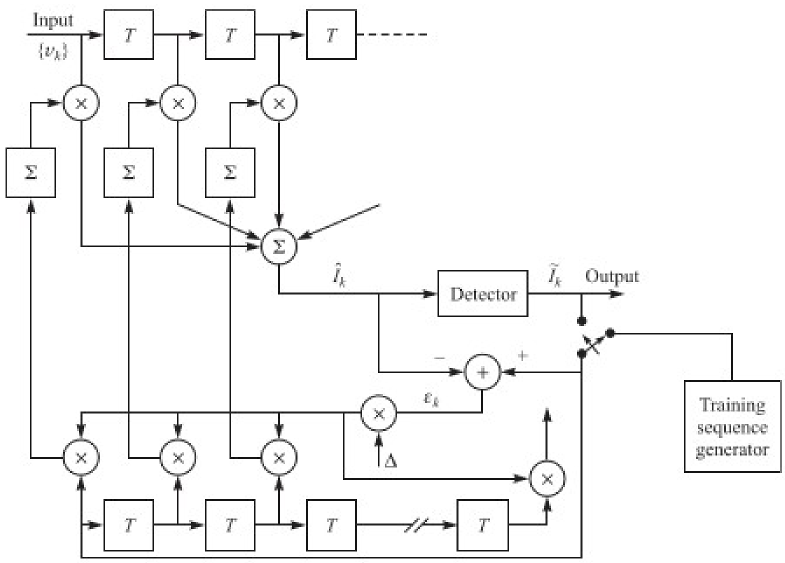

Figure 1. Adaptive Zero-forcing Equalizer Implementation[1]

System Design

The pilot symbol sequence $\mathbf{I_k}$, is used to update equalizer coefficients. The received signal,

$\mathbf{v_k} = \sum_{i=0}^{N} I_{k-i} * f_i$ where, $\mathbf{f_i}$ is the channel coefficients and **N** is the number of channel coefficients. The equalizer update algorithm is,

$c_j^{k+1} = c_j^k + \Delta \epsilon_k I_{k-j}$, where $\mathbf{c_j}$ is the equalizer coefficients, Δ is the convergence rate, ε_k is the error sequence, $\varepsilon_k = I_k - I_k^{\sim}$ where $\mathbf{I_k}^{\sim}$ is the equalizer output sequence. Superscript denotes the discrete-time.

Simulation and Result

In the simulations, **5** tap multi-path channel,

H = [1 0.3 0.6 0.4 0.23] is used. Number of equalizer taps is chosen as **10** and number of pilot symbols is **10000**. Symbols are **BPSK** modulated. Convergence rate is **0.001**.The performance of zero forcing algorithm is evaluated in terms of **MSE** between training sequence and equalizer output.

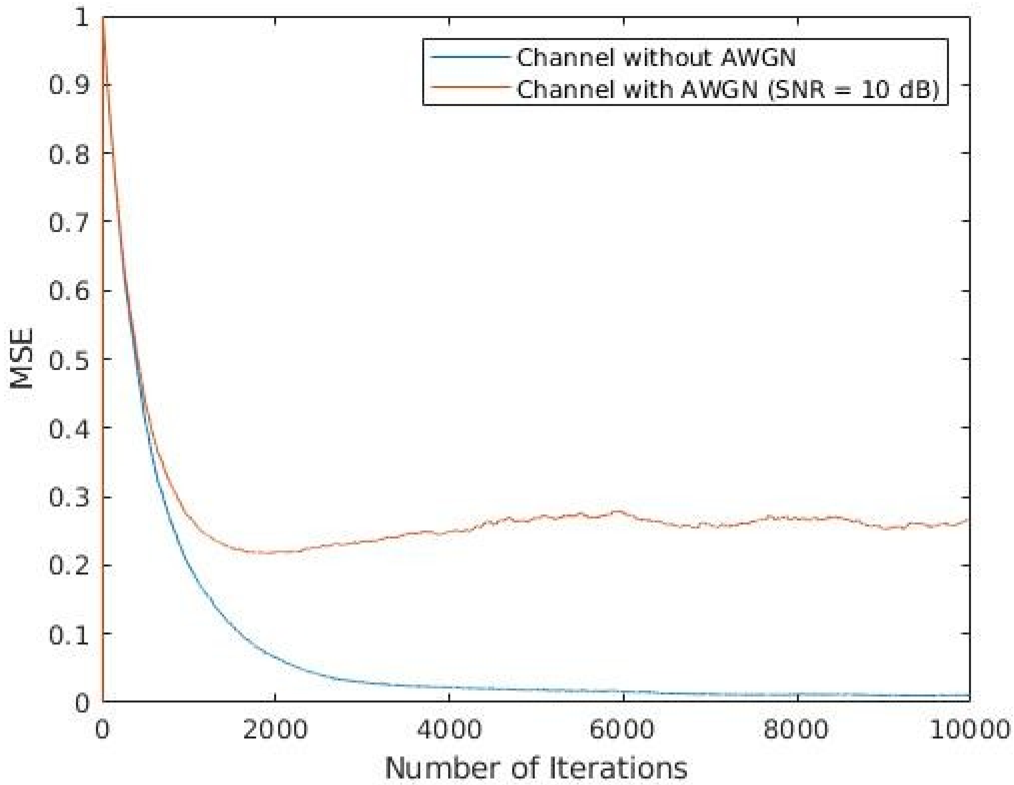

Figure 2. Adaptive Zero-forcing Algorithm Simulation Result

As shown in graph above, The performance of the algorithm is fine without AWGN.

References

[1] Proakis (2007). *Digital Communications 5th Edition*. McGraw Hill. Page. 691