Robust Decision Feedback Equalizers for High Speed Data Communications

High speed communication channels frequently distort and introduce random noise into transmitted signals. These channel distortions result in intersymbol interference (ISI), which, if left uncompensated, causes high error rates. To reconstruct the transmitted signal, the receiver must compensate for the channel distortion and minimize the impact of the channel noise. Such compensation is called equalization, and it is at the heart of most communication systems. In high data rate transmissions over wired communication systems, ISI becomes increasingly severe. As a result, nonlinear equalizers are required to reduce the effect of channel distortions. Decision Feedback Equalizers (DFE) are the most common nonlinear equalizers with fairly low complexity, fast convergence time, and good tracking capability. This equalizer class has the potential to compensate for amplitude distortion without providing noise enhancement in high speed systems.

In this project, the first goal is to evaluate the performance of several DFE structures on different channels in the presence of various impairments. These impairments include AWGN noise, interchannel and intersymbol interference, and jitter. It has been shown that DFEs have better performance on severely amplitude distorted channels and that DFEs can reject sinusoid, synchronous, and asynchronous narrowband interferences. Moreover, we evaluate the performance of the communication system in the presence of jitter.

The next goal of this project is to enhance performance through the design of a robust signaling scheme which is matched to highly distorted channels and compatible with current systems. This signaling scheme will be optimized to be robust to channel jitter and interchannel interference.