6 Conclusion and Suggestions for Future Works

The performance of blind equalization schemes can be improved by applying better algorithms that use modified error equations. For any adaptive algorithm the performance of the algorithm depends on the shape of the cost surface. Since one of the factors that determines the shape of the cost function is the definition of the error equation, different types of error equation were used for the improvement of the performance of CMA. Four different types of error equations were used in the simulations. The first one was the error equation generally used with CMA. The second and the third error equations are equations affine and logarithmic in the equalizer output amplitude respectively. The forth one was derived from the conventional error equation of CMA by making it symmetric about the zero error point. The simulation results show that the affine error equation provides a faster convergence rate than any of the other types of error equation used in the simulations. Furthermore, the affine error results in a lower steady state error for a specific external noise. However, for some channels, the estimate of the equalizer (inverse of the channel) may be biased when the affine error equation is used. This is a shortcoming of the logarithmic error also. Imposing unit norm on the equalizer impulse response solution can be helpful towards resolving this problem. An investigation of different techniques for eliminating bias would be a significant extension of the current research.

The modified logarithmic (symmetric about the zero error) error equation results in convergence to a global minimum for a differentially encoded system. The steady state error of CMA with the logarithmic error equation is comparable to that with the affine error equation. The initial convergence rate of the adaptation process is slower with the logarithmic error equation. A piece-wise combination of the affine and logarithmic errors is expected to provide a more optimal error equation for CMA and its investigation would be a good topic for the future research.

We showed that the tracking property of a blind equalizer can be improved by using a predictor at the output of the equalizer that adjusts for the fading gain of the channel.

Conventional error equations were used for this modified equalization structure. However, further gains may be achieved by combining the modified error equations with the proposed equalizer structure. This might be another area of future research. Moreover, a linear compensation for the channel gain may provide better performance. For linear compensation, instead of dividing the equalizer output (as used in the present model) by the predictor output, something like the following equation is used:

$$y(n) = y_e(n) + sign\left[y_e(n)\right]\left\{A - \hat{y}_{env}(n)\right\} \tag{6.1}$$

In (6.1) $y_e(n)$ is the equalizer output, $\hat{y}_{env}(n)$ is the estimated value of the envelope of the equalizer output and A is the desired amplitude level. The proposed compensation may perhaps result in a more analytically tractable system than the system used in this work.