

# Fractionally Spaced Blind Equalizer Performance Improvement

by

Pulakesh Roy

Dr. A. A. (Louis) Beex, Chairman

The Bradley Department of Electrical and Computer Engineering

## (ABSTRACT)

Blind equalization schemes are used to cancel the effects of a channel on the received signal when the transmission of a training sequence in a predefined time slot is not possible. In the absence of a training sequence, blind equalization schemes can also increase the throughput of the overall system. A general problem with blind adaptation techniques is that they have poor convergence properties compared to the traditional techniques using training sequences. Having a multi-modal cost surface, blind adaptation techniques may force the equalizer to converge to a false minimum, depending on the initialization. The most commonly used blind adaptation algorithm is the *Constant Modulus Algorithm* (CMA). It is shown by simulation that a logarithmic error equation can make CMA converge to a global minimum, if a differential encoding scheme is used. The performance of CMA with different error equations is also investigated for different channel conditions.

For a time varying channel, the performance of an equalizer not only depends on the convergence behavior but also on the tracking property, which indicates the ability of an equalizer to track changes in the channel. The tracking property of a blind equalizer with CMA has been investigated under different channel conditions. It is also shown that the tracking property of a blind equalizer can be improved by using a recursive linear predictor at the output of the equalizer to predict the amplitude of the equalizer output. The predicted value of the amplitude is then used to adjust the instantaneous gain of the overall system.

A recursive linear predictor is designed to predict a colored signal without having a priori knowledge about the correlation function of the input sequence. The performance of the designed predictor is also investigated by predicting the envelope of a flat fading channel under constant mobile velocity and constant acceleration conditions.