MR2-02 MIMO FDE SYSTEM

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People are enjoying very much the convenience of getting entertainment brought by the advance technologies in audio and video processing. As multimedia communications (transmission of audio and video signal) require high bit rate wireless access. All people aim to transmit as much and as fast as possible. Furthermore, other than the capacity of transmitting, the errors find in the received signal during transmission are a big problem that engineers need to solve.

**Simulation in wireless transmission.**

**Use multiple transmitters and multiple receivers (MIMO) for transmission.**

**Use equalization to overcome the inter-symbol interference (ISI), multipath effect. (Single Carrier Frequency Domain Equalizer)**

**Compare the performance in term of bit error rate**

Simulation plays an important role in designing communication system. Since it shows the estimation of the performance of the systems without building the systems practically. It also computes the performance by bit error rate, which cannot be found easily in practical. Matlab programming language is used for simulating the performance.

Simulating the transmission through different channels:
1. Flat fading channel
2. Two-way and exponential profile in frequency selective channel

Simulating the equalization through different equalizers:
1. Time domain equalizers (ZFE, MMSE)
2. Frequency domain equalizers (FDE, LSFE, FD-DFE)

The results will be useful in IEEE 802.16 when we have NLOS communication.
Figure 1: MIMO FDE System

Transmitter

- Modulate the data streams to QPSK and transmit them from each antenna
- Add cyclic prefix into transmitted signals and convolute with channel
- Convert M sample signals from serial to parallel at each antenna (S/P)
- Convert the outputs back to QPSK by hard decision for detection
- Transfer KM outputs into time domain by IFFT operation
- FDE with LM inputs and KM outputs perform channel equalization

Receiver

- Transfer signals into frequency domain by FFT operation
- Convert outputs back from parallel to serial (P/S)
- FDE with LM inputs and KM outputs perform channel equalization

Figure 2: System Description
Computing the performance in term of bit error rate (BER) against Signal to Noise Ratio (SNR):

**Figure 3:** Uncoded OFDM, LSFE, FD-DFE and OFDM with 4 transmitted antennas

**Figure 4:** Uncoded LSFE, FD-DFE and OFDM with 4 transmit, 4 receive antennas SNR= 20dB