6.02 Lecture 6 – Decision Fdbk Equalization

- **Eye Reminder**
  - Eye diagram and Sample point
  - Noisy Eye

- **Improving the Wire**
  - Why deconvolution su...uhm does not work
  - Decision Feedback Equalization Idea
  - Using previous bit-based pulse response

- **Error Estimation**
  - Probabilistic Analysis
Can Signal Processing Help?

Model Wire as Causal and Linear Time-Invariant
Eye Diagram, Slow Wire, 25 Samples/Bit
Eye Diagram with Noise (st.dev. = 0.1)
Slow Wire and 20 Samples per bit

6.02 Spring 2009
Deconvolution Great Unless There’s Noise
0.5 high 25 Sample Pulse Response
3rd Bit easier to Detect if 2\textsuperscript{nd} Bit = 1/2

Note Higher Peak - Third Bit One Easier to Detect
Bit 2 is known (0), can add pulse

Transmitting 0010

Bit 2 = 0, so add half pulse

Receiving 0010

Note Higher Peak - Third Bit One Easier to Detect

Like Transmitting 0(1/2)10

Sum just like Receiving 0(1/2)10
2\textsuperscript{nd} Case: Bit 2 is known (1), subtract pulse

Note Lower Dip – Third Bit One Easier to Detect
Only need to adjust near detection sample

Receiving 0010

Bit 2 = 0, so add half pulse, but only near detection time for bit 3 (sample85)

DFE adjusted received waveform

Third Bit further from threshold for samples used in detection

Receiving 1101

Bit 2 = 1, so subtract half a pulse, but only near detection time for bit 3 (sample85)

DFE adjusted received waveform
Eye Diagram with Ideal DFE (from 3-22)
Eye Diagram with DFE and Noise
Eye Diagram with Incorrect DFE
Eye Diagram with DFE and Noise

No DFE

Real DFE

Ideal DFE