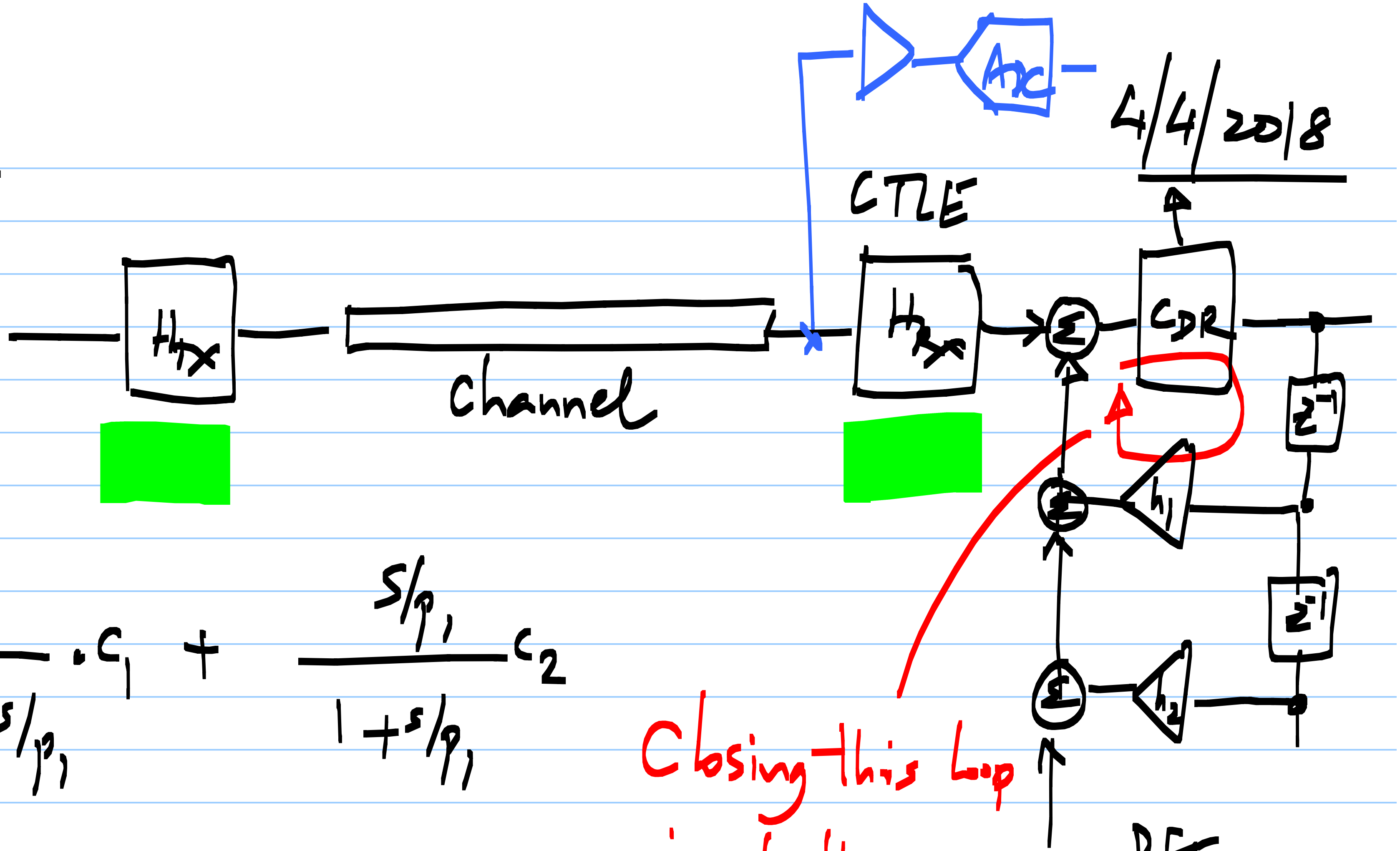
EE 6322

4/4/2018

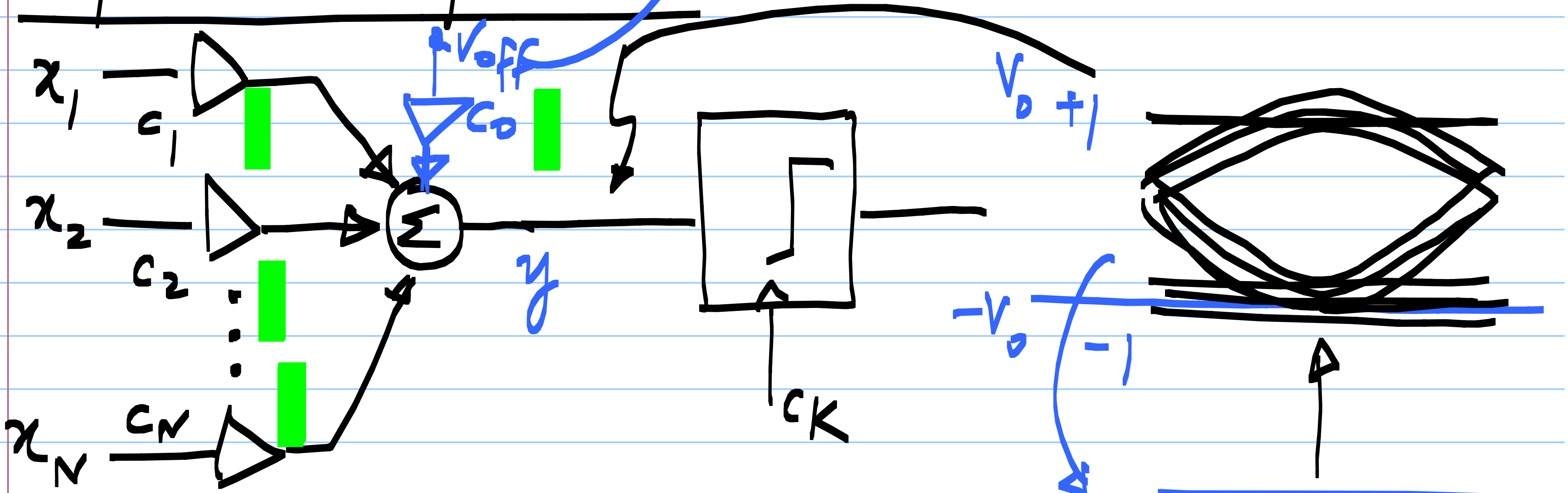


Closing this loop is challenging

$$\frac{1}{1+s/p_1}\cdot c_1 + \frac{s/p_1}{1+s/p_1} c_2$$

Equalizer adaptation:

CDR has converged)

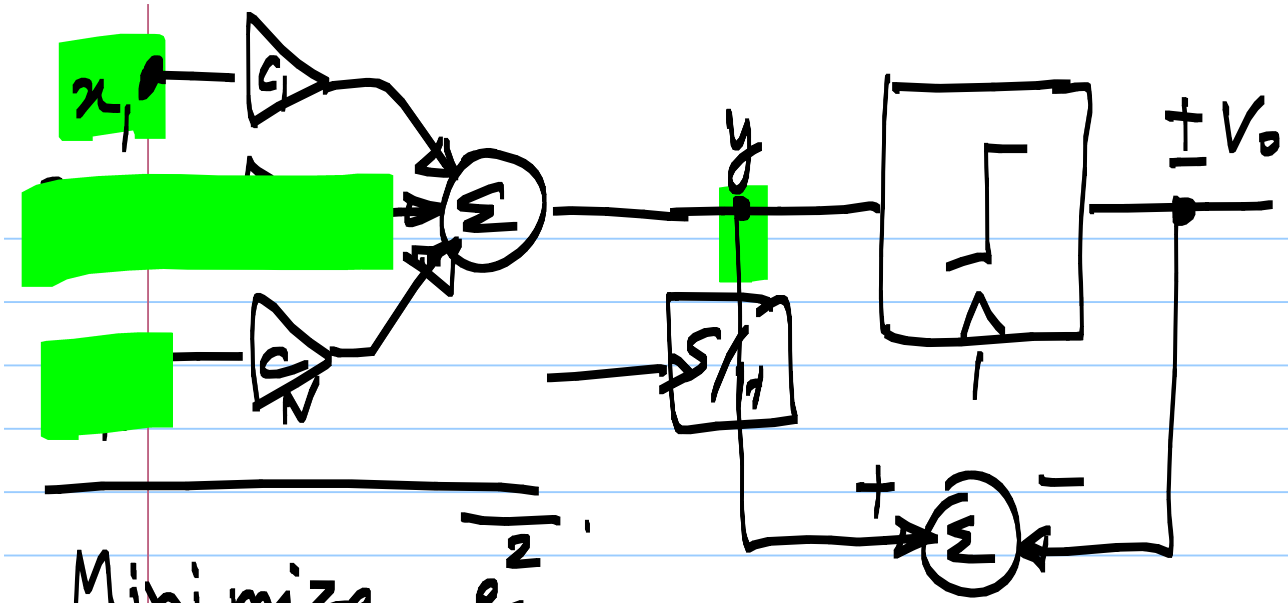


Target eye diagram

$$\sum c_k \cdot x_k$$

$$y = \sum c_k x_k$$

$\pm V_0$: target levels for ± 1



Pulse response

$\sum h_k z^{-k}$

Minimize $\overline{e^2}$.

(Minimum mean-squared error)

Adjust c_k

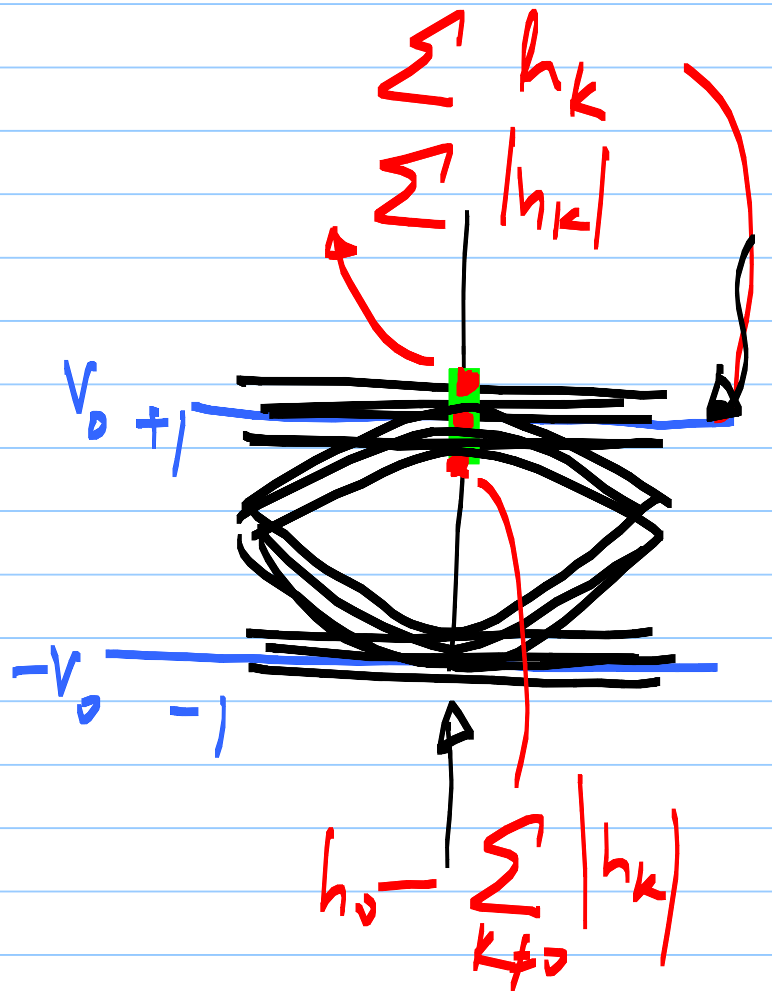
$e > 0$

$y + V_0$

or $y - V_0$

$(+1)$ $y > V_0$

(-1) $y > -V_0$



$$e = y \pm v_0$$

$$\underbrace{e^2 = \left(y \overset{(+1)}{-} v_0\right)^2} \quad \text{or} \quad \left(y \overset{(-1)}{+} v_0\right)^2$$

Gradient descent algorithm:

$$e^2 = (y - v_0)^2 = \left(\sum_k c_k x_k - v_0\right)^2$$

$$\frac{\partial}{\partial c_k} \cdot e^2 = 2e \cdot \frac{\partial e}{\partial c_k} = 2e \cdot x_k$$

[redacted]

$$c_k[n+1] = c_k[n] - \underline{\underline{\mu}} \cdot e \cdot x_k$$

Gradient descent algorithm:

Coefficient update equation:

$$c_k[n+1] = c_k[n] - \mu \cdot e \cdot x_k$$

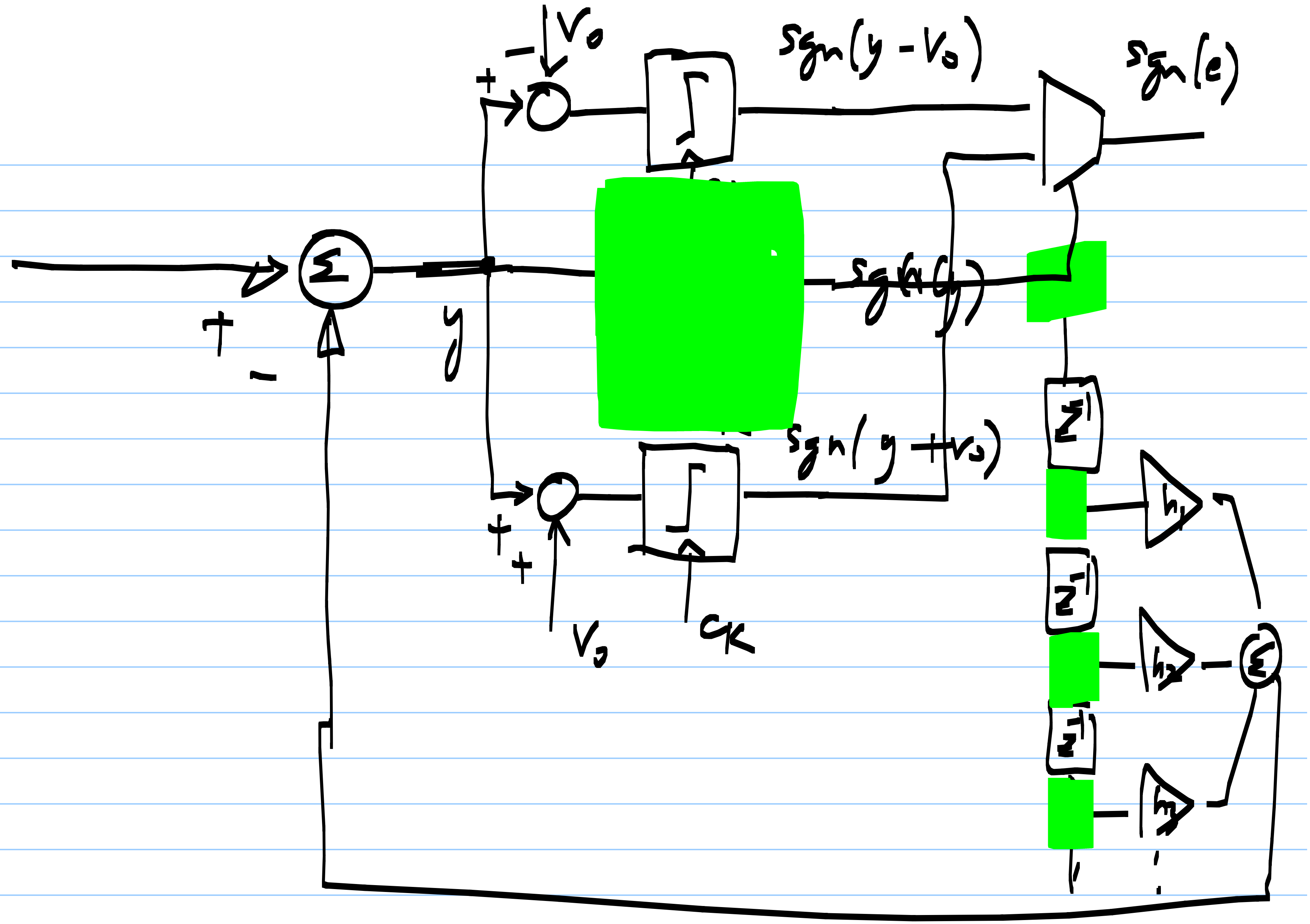
{reduce the value of e^2 by tweaking c_k}

$$c_k[n+1] = c_k[n] - \mu \, \mathrm{sgn}(e) \cdot \mathrm{sgn}(x_k)$$ ✓

Sign-Sign LMS algorithm

$-\underline{e \cdot \mathrm{sgn}(x_k)}$; $-\underline{\mathrm{sgn}(e) \cdot x_k}$

Step-size : μ


+
-
Σ
y
+
-
V_o
+
+
V_o
CK
sgn(y - V_o)
sgn(y)
sgn(y + V_o)
sgn(e)
z^-1
z^-1
z^-1
h_1
h_2
h_3
Σ