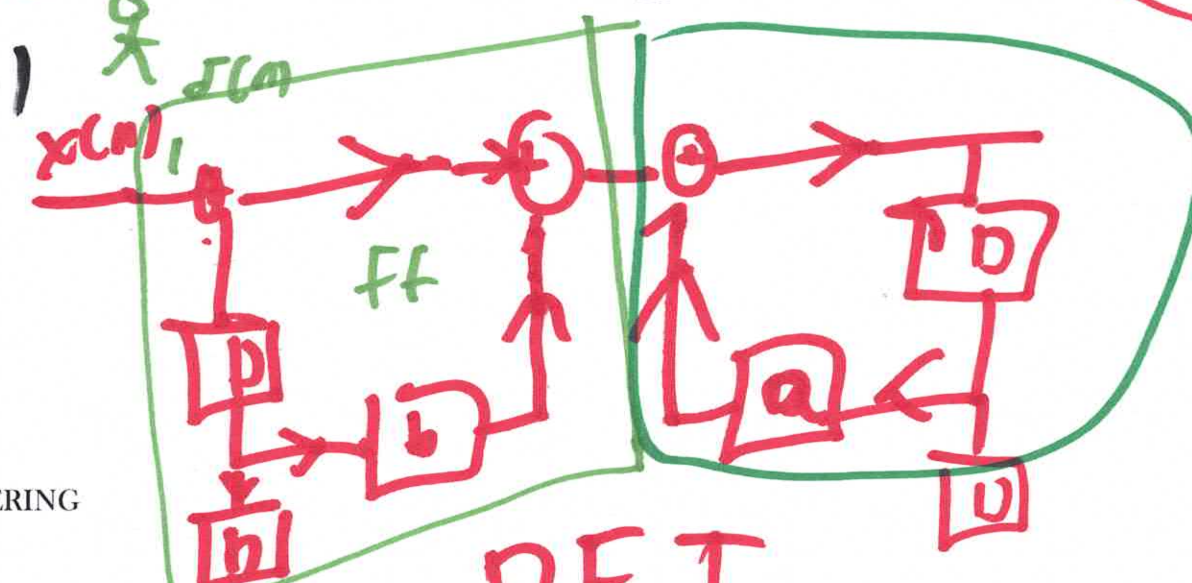
EE360:

Office Hours FRIDAY 10/23/2020 @ noon

h(n)

$$y(n) - 2r\cos(w_0)\,y(n-1) + r^2\,y(n-2) = r\sin(w_0)\,x(n-1)$$



DF I

$$\delta(n) = x(n) \longrightarrow \boxed{h(n)} \longrightarrow y(n)$$

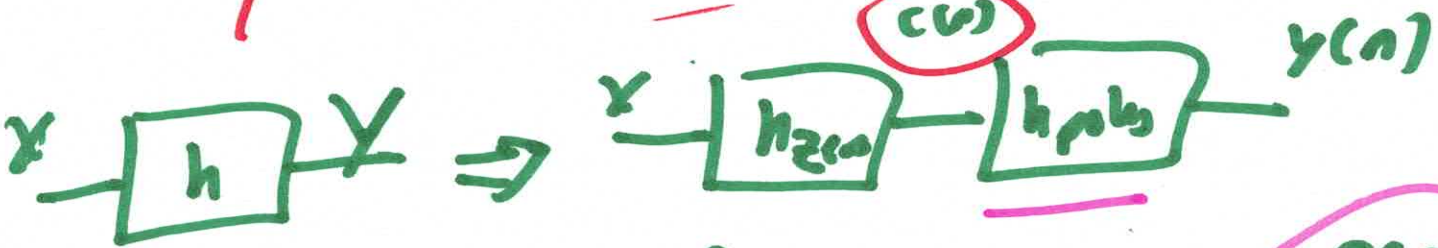
$$y(n) = x(n) * h(n)$$

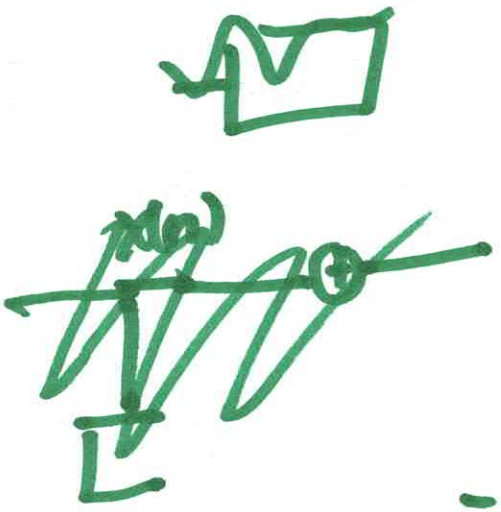
$$= \delta(n) * h(n)$$

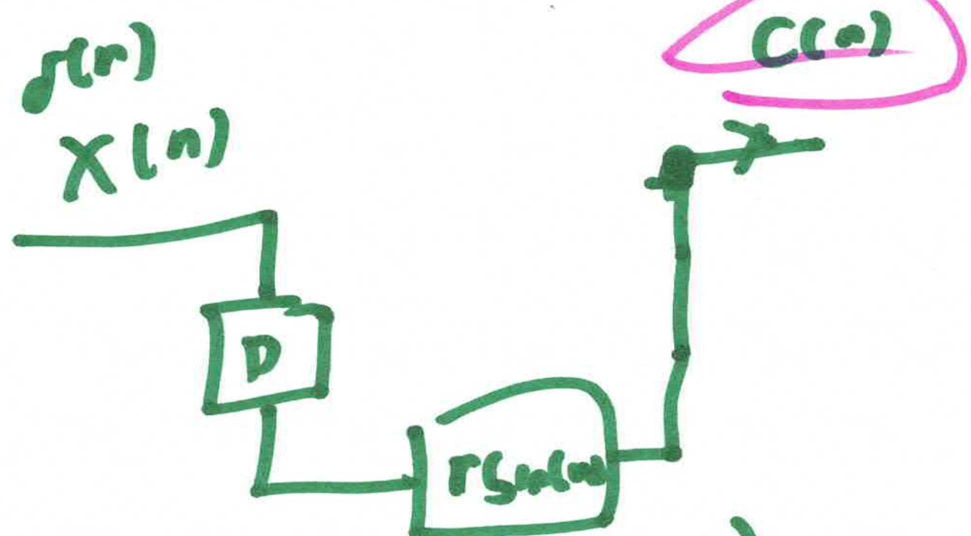
$$\boxed{y(n) = h(n)} \rightarrow \cancel{h(n)} = y(n)$$

$$h(n) - 2r\cos(\omega_0)\, h(n-1) +$$

$$y(n) - 2r\cos(w_0)\,y(n-1) + r^2 y(n-2) = r\sin(w_0)\,x(n-1)$$





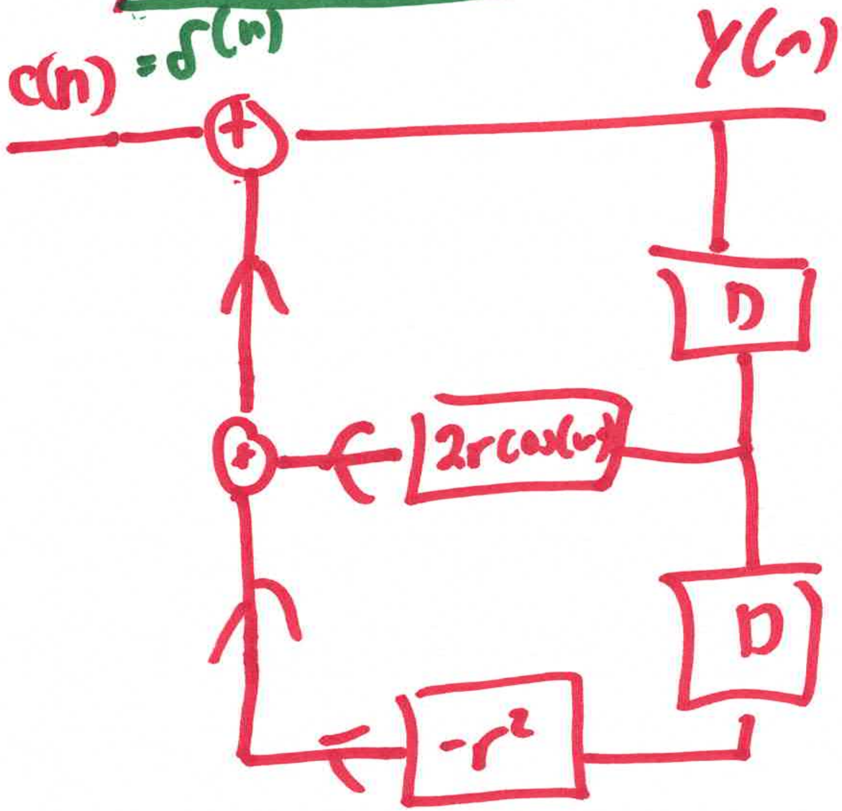


$$= c(n) = r\sin(w_0)\,\delta(n-1)$$

$$c(n) = \delta(n) * h_{zero}(n)$$

$$c(n) = h_{zero}(n)$$

$$y(n) - 2r\cos(w_0)\,y(n-1) + r^2 y(n-2) = c(n)$$



$$y(n) = c(n) + 2r\cos(w_0) - r^2 y(n-2)$$

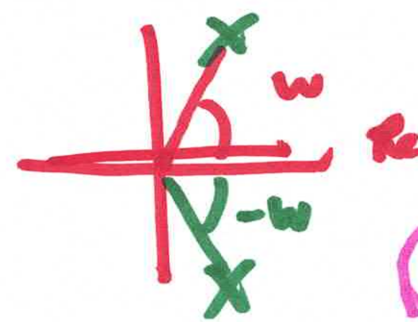
Aux Eqn

$$1 - 2r\cos(w_0)\lambda^{-1} + r^2\lambda^{-2} = 0$$

$$\lambda^2 - 2r\cos(w_0)\lambda + r^2 = 0$$

$$(\lambda - re^{-jw})(\lambda - re^{+jw})$$

$$\boxed{\lambda = re^{\pm jw}}$$



$$y(n) = C_1(\lambda_1)^n + C_2(\lambda_2)^n$$

$$y(n) = C_1\left(re^{+j\omega}\right)^n + C_2\left(re^{-j\omega}\right)^n$$

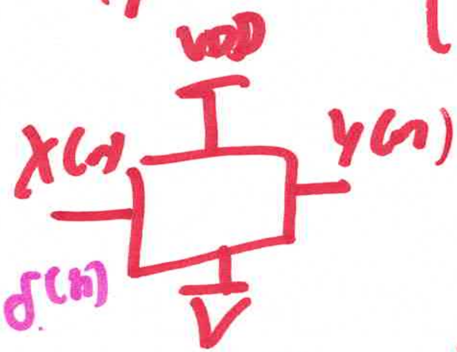
$$y(0) = 1 = C_1(1) + C_2(1)$$

$$y(1) = 0 = C_1 re^{+j\omega} + C_2 re^{-j\omega}$$

$$h(n) - 2r\cos(\omega_0)\, h(n-1) + r^2 h(n-2) = r\sin(\omega_0)\,\delta(n-1)$$

$$h(n) = r\sin(\omega_0)\,\delta(n-1) + 2r\cos(\omega_0)\,h(n-1) - r^2 h(n-2)$$

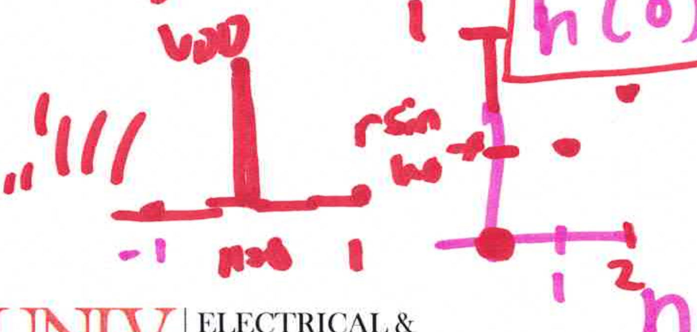
$$|y(n)| = \left|\sum_{-\infty}^{\infty} h(n)\,x(n)\right| \le \left|\sum_{n=-\infty}^{\infty} h(n)\right| |x(n)|$$



$n = 0$

$$h(0) = r\sin(\omega_0)\,\cancel{\delta(-1)} + 2r\cos(\omega_0)\,\cancel{h(-1)} - r^2 \cancel{h(-2)}$$

$$\boxed{h(0) = 0}$$



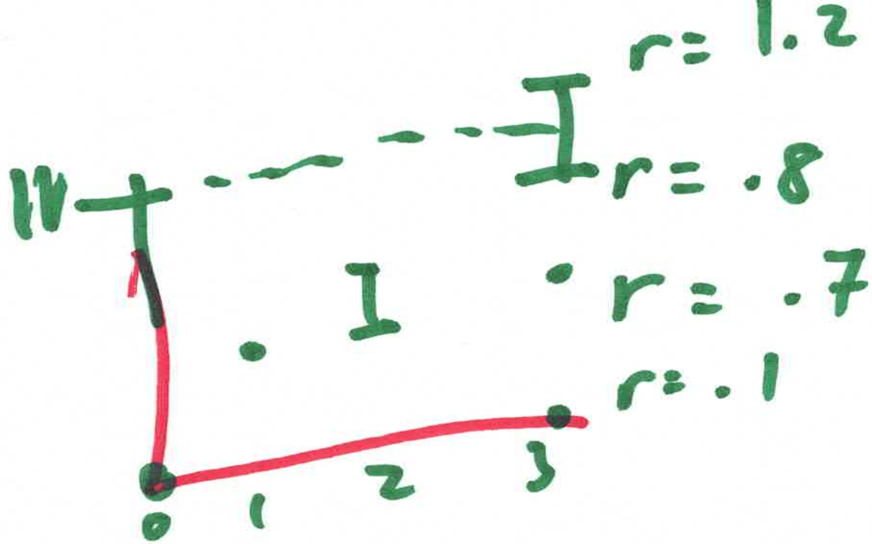
$$h(1) = r\sin(\omega_0) + 2r\,\cancel{\cos(\omega_0)\,h(0)}$$

$n = 1$ $\boxed{h(1) = r\sin(\omega_0)}$

$$\boxed{h(2) = 2r\cos(\omega_0)\,h(1)} - r^2 \cancel{h(0)}$$

r

6



$r \leq K$

$$y(n) = x(n) + \beta x(n-1) - \alpha y(n-1)$$

n<0

$$h_{zeros} = \delta(n) + \beta\delta(n-1)$$

$$h_{poles} = (-\alpha)^n u(n)$$

$$h(n) = h_{zeros} * h_{poles}$$

$$h(n) = (-\alpha)^n u(n) + \underset{(-\alpha)}{\underline{\beta}}(-\alpha)^{n-1} u(n-1)$$

$\alpha = .99$

$\alpha = 1.01$

$$\left|\sum_{n=-\infty}^{\infty} h(n)\right|$$

(1) y(n)

n: [-2 -1 0 . . . .]

y: [$-r^{-2}\sin(2\omega_0)$ . .

$\underbrace{\qquad\qquad}$

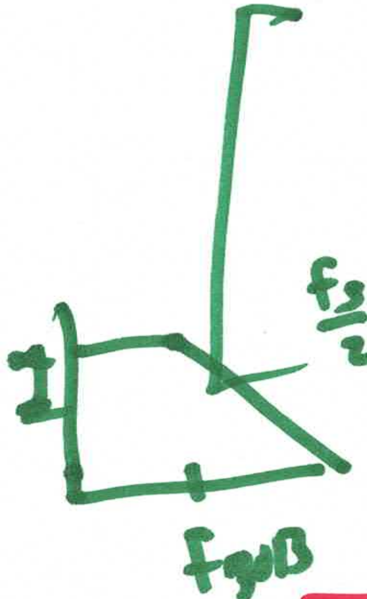
prolong+1

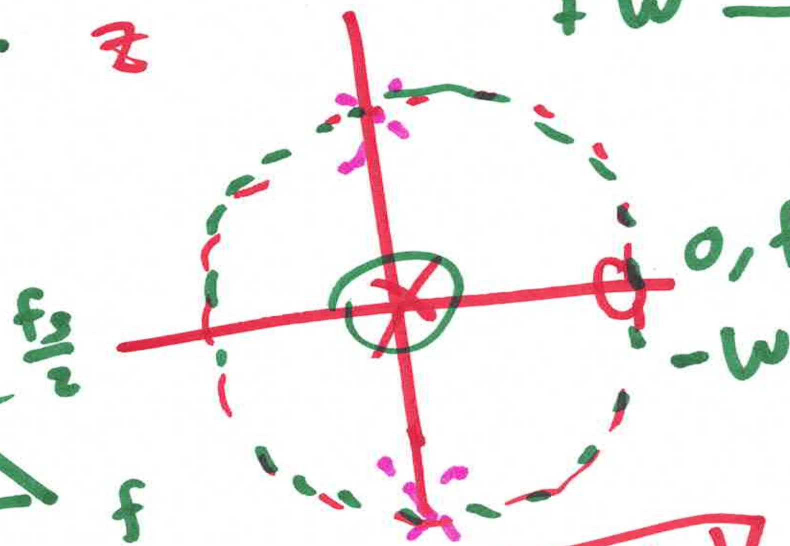
Z - domain

$$y(n) = x(n) * h(n)$$

$$Y(z) = X(z)\,H(z)$$

$$\boxed{H(z) = \frac{Y(z)}{X(z)} = \frac{V_{out}(z)}{V_{in}(z)}}$$





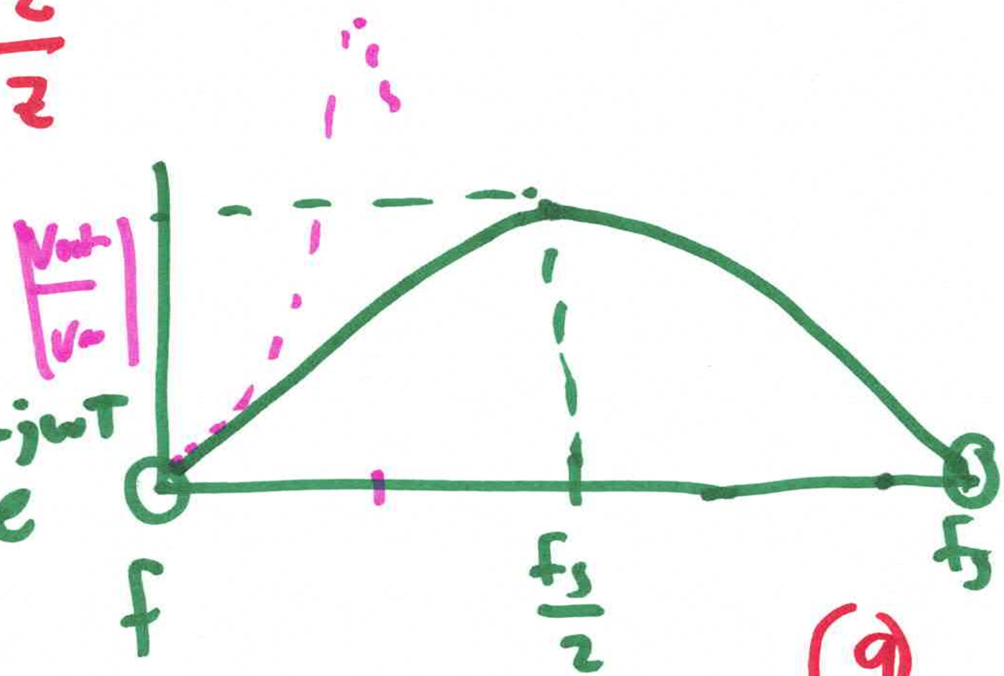
$$\boxed{H(z) = (1 - z^{-1})}\,\frac{z}{z}$$

$$\boxed{H(z) = \frac{z - 1}{z}}$$

$$z = e^{j\omega T}$$

$$H(\omega) = 1 - e^{-j\omega T}$$

$$= e^{-j\omega \frac{T}{2}}\Big($$



$$= e^{-j\frac{\omega}{2}T}\left[e^{+j\frac{\omega}{2}T} - e^{-j\frac{\omega}{2}T}\right]\frac{2j}{2j}$$

$$j = e^{j\frac{\pi}{2}}$$

$$= e^{j\frac{\omega}{2}T}\sin\left(\frac{\omega T}{2}\right)2j$$

$$= 2e^{j\left(\frac{\omega}{2}T + \frac{\pi}{2}\right)}\sin\left(\frac{\omega T}{2}\right)$$

$$|H(\omega)| = 2\left|\sin\left(\frac{\omega T}{2}\right)\right|$$

$$|1 - (\cos\omega T - j\sin\omega T)|$$