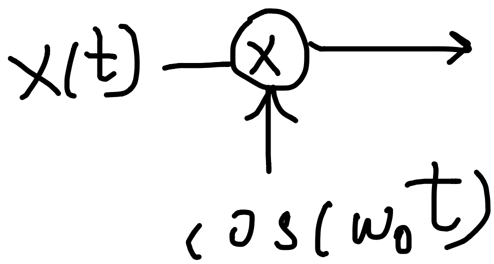
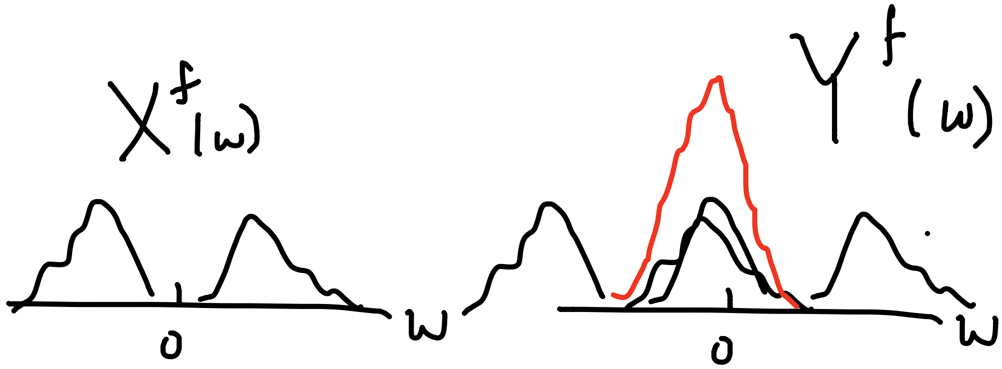
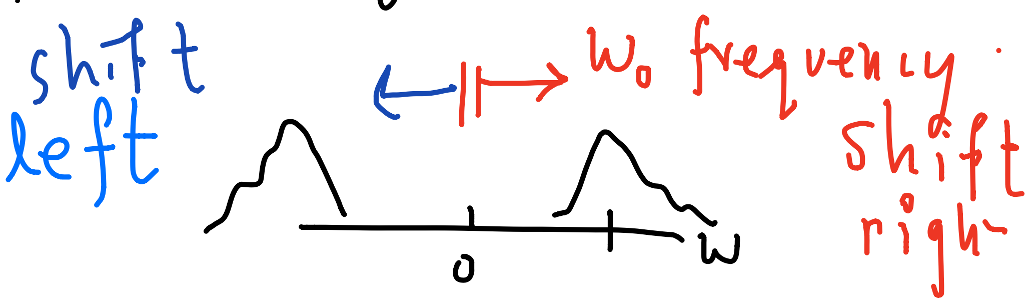
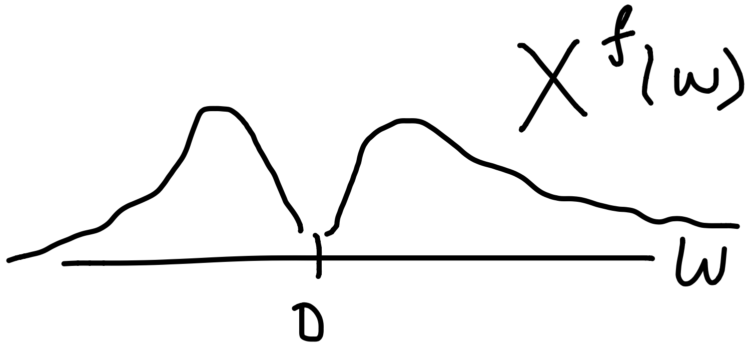


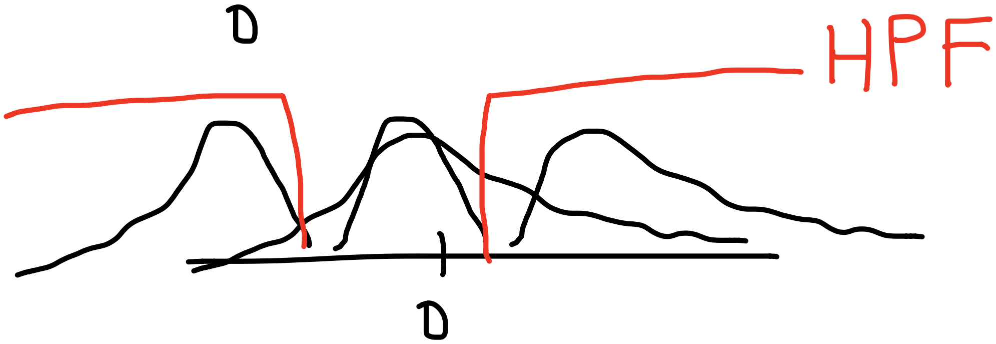
$$y(t) = x(t)\cos(\omega_0 t)$$

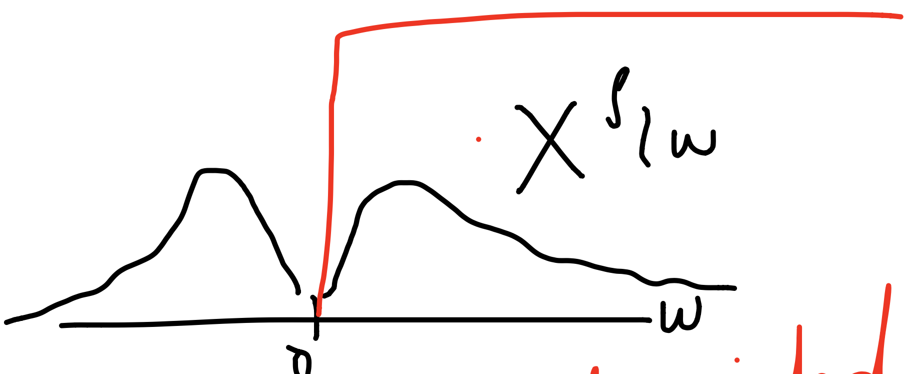


can we do some other type of processing to achieve:



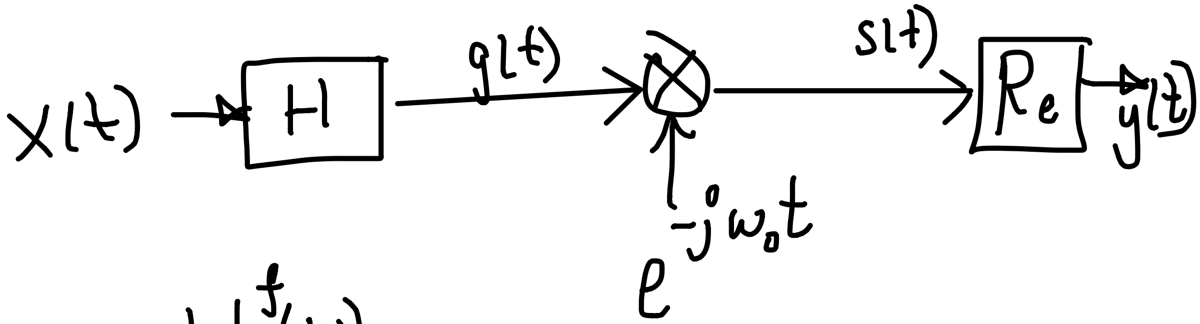


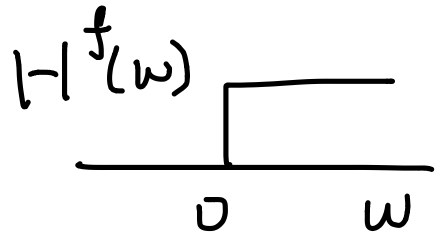


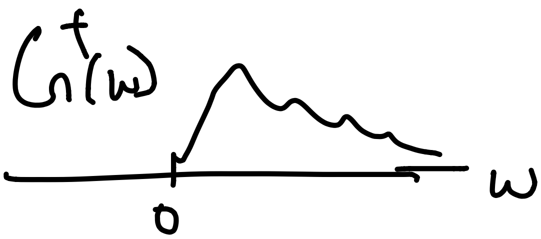


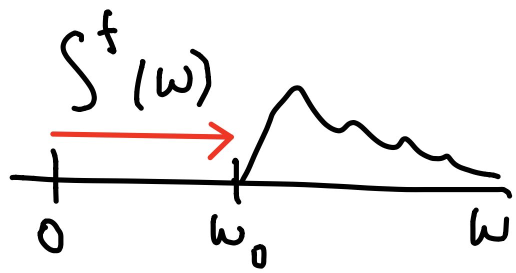
$$|H^f(\omega)| = \begin{cases} 1, & \omega > 0 \\ 0, & \omega < 0 \end{cases}$$

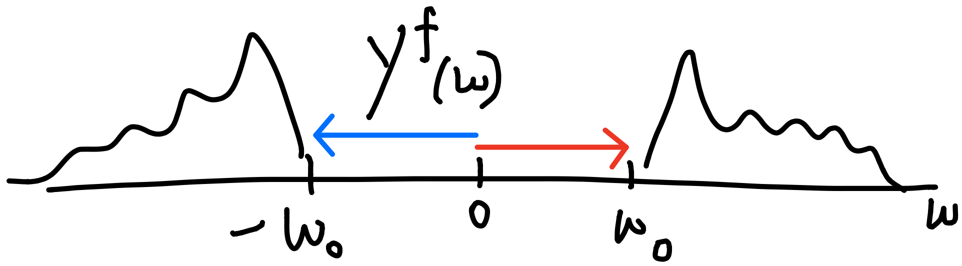
single sided frequency response





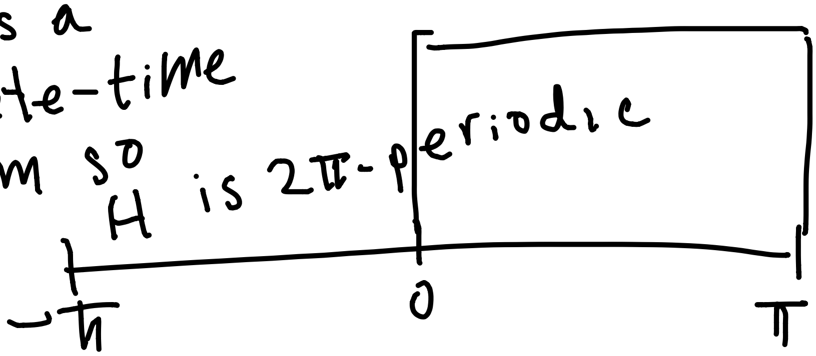






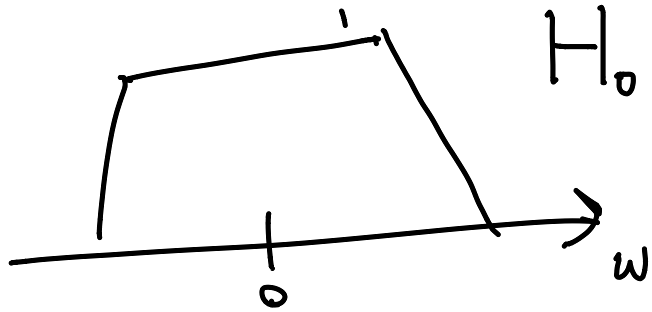
How to design $H^f(\omega)$?

This is a discrete-time system so H is 2π-periodic



A: shift (in freq.) a LPF

Lets start w/ LPF



$$H_0(z) = \frac{B_0(z)}{A_0(z)}$$

$$H^f(\omega) = H_0^f\left(\omega - \frac{\pi}{2}\right)$$

$H(z) = ?$

$$\boxed{H_0^f(\omega) = H_0(e^{j\omega})}$$

$$H_0^f\left(\omega - \frac{\pi}{2}\right) = H_0\left(e^{j(\omega - \pi/2)}\right)$$

$$= H_0\left(e^{j\omega} e^{-j\pi/2}\right)$$

$$= H_0\left(-j e^{j\omega}\right)$$

$$= H^f(\omega) = H(e^{j\omega})$$

$$\boxed{H(z) = H_0(-jz)}$$

$$H_0(z) = \frac{B_0(z)}{A_0(z)}$$

$$= \frac{b_0 + b_1 z^{-1} + b_2 z^{-2}}{a_0 + a_1 z^{-1} + a_2 z^{-2}}$$

for a $2^{\underline{nd}}$ order system.

$$H_0(-jz) = \frac{b_0 + b_1(-jz)^{-1} + b_2(-jz)^{-2}}{a_0 + \cdots}$$

$$= \frac{b_0 + b_1(-j)^{-1} z^{-1} + b_2(-j)^{-2} z^{-2}}{a_0 + \cdots}$$

new coeffs of $H(z)$

$$\tilde{b}_k = b_k(-j)^{-k} \qquad \tilde{a}_k = a_k(-j)^{-k}$$

$$= b_k(j)^k \qquad \tilde{a}_k = a_k(j)^k$$