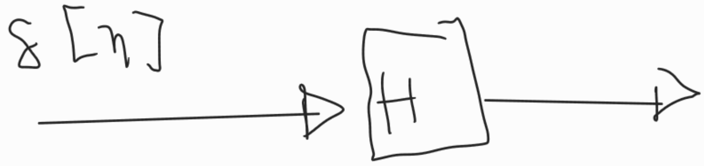
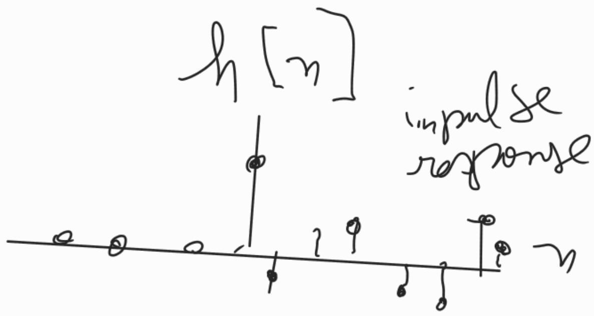
Characterizing linear, time-invariant systems using canonical inputs -

1) Write arbitrary input as a weighted sum of time-shifted canonical input

2) Output is a weighted sum of time-shifted canonical outputs





$$y[n] = \sum_{k=-\infty}^{\infty} h[k]\, x[n-k] =$$

$$h[n] * x[n]$$

$\hat{z}$ operator notation

Properties

1) Causal system

$$y[n] = \sum_{k=-\infty}^{\infty} h[k]\, x[n-k]$$

$$= \ldots + h[-2]\,x[n+2] + h[-1]\,x[n+1] + h[0]\,x[n] +$$
$$h[1]\,x[n-1] + \ldots$$

Causal $\Longleftrightarrow$ $h[n] = 0$ for $n < 0$

2) Finite impulse response (FIR):

number of nonzero $h[n]$ is finite

Most common form $h[n] = 0$

$n < 0$, $n \geq N$

$$y[n] = \sum^{N-1} h[n]\, x[n-k]$$

$$= h[0]x[n] + h[1]x[n-1] + \dots$$

$$+ h[N-1$$