$y[n] = x[n] + \frac{1}{2}x[n-1] + \frac{1}{3}x[x-2] + \dots$

$y[n] = \sum_{i=0}^{N} a_i \, x[n-i]$ causal non-recursive LTI systems

depends only on inputs

$y[n] = x[n] + \frac{1}{2}y[n-1] + \frac{1}{2}x[n-2] + \frac{1}{3}y[n-2] + \dots$

$y=[n) = \sum_{i=0}^{N} a_i \, x[n-i] + \sum_{i=1}^{M} b_i \, y[n-i]$

depends on inputs and output values

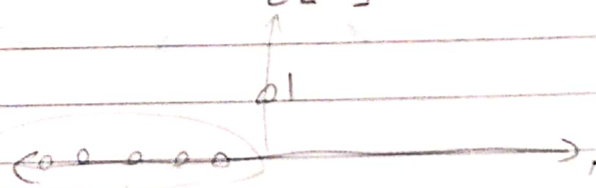
causal recursive LTI systems

N and M any numbers, doesn't have to equal

$y[n] = x[n] + \frac{1}{2}y[n-1]$, find $h[n]$

soln.: $h[n] = \delta[n] + \frac{1}{2}h[n-1]$ useless

$\delta[n]$



$n<0 \rightarrow h[n] = 0$

no previous values from $-\infty$ → no output

$n=0 \rightarrow h[0] = 1 + \frac{1}{2} \times 0 = 1$

$n=1 \rightarrow h[1] = 0 + \frac{1}{2} \times 1 = \frac{1}{2}$

$n=2 \rightarrow h[2] = 0 + \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$\vdots$

$n \geq 0 \quad h[n] = \left[\frac{1}{2}\right]^n$

so $h[n] = \left[\frac{1}{2}\right]^n u[n]$

in the project: $h_2[n]$ is recursive

fourier series:

$x(t) \rightarrow$ periodic signal, period $= T$

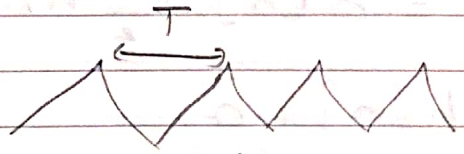
$$\omega_0 = \frac{2\pi}{T}$$

$$x(t) = \underbrace{\sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t}}$$

FS coefficients $a_0, a_{\pm 1}, a_{\pm 2}$ ——

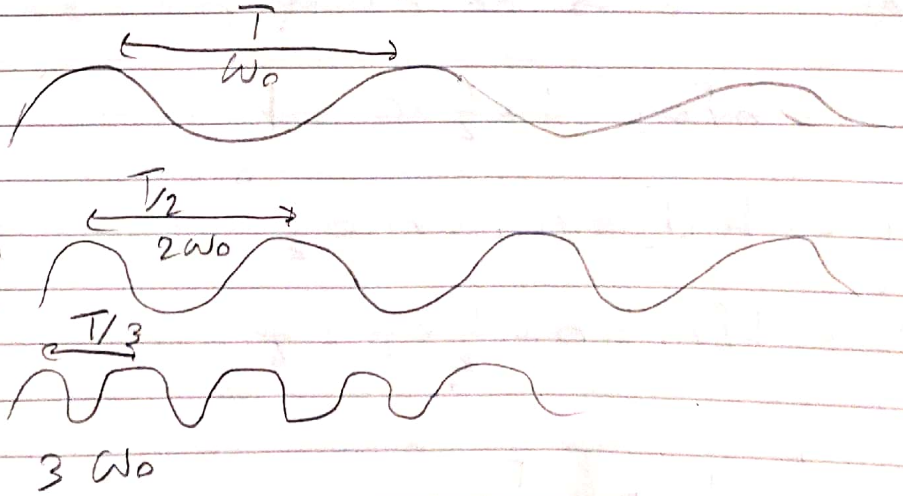
$$\boxed{\begin{aligned} e^{jx} &= \cos(x) + j\sin(x) \\ \cos(x) &= \frac{e^{jx}}{2} + \frac{e^{-jx}}{2} \\ \sin(x) &= \frac{e^{jx}}{2j} - \frac{e^{-jx}}{2j} \end{aligned}}$$

RHS: $x(t) \rightarrow$



$$\omega_0 = \frac{2\pi}{T}$$

LHS: a_1



$+ \; a_2$

$+ \; a_3$

$+$

to get $x(t)$ add all terms at any t

why FS?

sinusoidals are easier in operations
they make every thing algebraic