Discrete time complex exponentials

$$x[n] = |A|e^{j(\omega_0 n + \theta)} = |A|\cos(\omega_0 n + \theta) + j|A|\sin(\omega_0 n + \theta)$$

periodic if: $\omega_0 = 2\pi m/N$, m and N > 0 + no div.

★ Unit Step + Unit Sample

$$u[n] = \begin{cases} 1 & n \geq 0 \\ 0 & n < 0 \end{cases} \qquad \delta[n] = \begin{cases} 1 & n = 0 \\ 0 & \text{otherwise} \end{cases}$$

IIR Eq (ARMA)

$$y[n] = 0.5\,y[n-1] + x[n] + x[n-1]$$

↰ Clue for IIR!

FIR Eq.

$$y[n] = \sum_{k=0}^{m} h\, x[n-k] \quad \Rightarrow \quad \text{no feedback}$$

★ Tabular Method for convolution

★ Causal — no init conditions (no n < 0) + no feedback

Nyquist: $F_s \geq 2 \cdot f_{max}$

- Filter Order

$$N \cong \frac{A}{20(\omega_s - \omega_p)/2\pi}$$

→ attenuation   (add 10%?)

→ pass + stop f.

- Attenuation Eq.

$$A = 20\log_{10}\left(\frac{y}{x}\right) = 10\log_{10}\left(\frac{P_y}{P_x}\right)$$

Sampling Stuff

$\text{Latency} = \dfrac{NB}{2} \cdot T_s$ ↙ buffer size

NFFT $= 2^N$

$\begin{array}{l}\text{Overlap} \\ \text{(standard)}\end{array} = \dfrac{NFFT}{2}$ ← window size

$\Delta f = \dfrac{F_s}{NFFT}$

$t_w = \dfrac{NFFT}{F_s}$

One - Sided Z-transform
(there are more)

$\delta[n] \longrightarrow 1$

$u[n] \longrightarrow \dfrac{1}{1 - z^{-1}}$

$nu[n] \longrightarrow \dfrac{z^{-1}}{(1 - z^{-1})^2}$

Ex:

$Z(u[n]) = \dfrac{1}{1 - z^{-1}} = \dfrac{z}{z - 1}$

mult. by z