Le31

Monday, 5 June 2023 10:36

Es1

$$y(n) = x(n-2) + \sum_{k=-\infty}^{-n-5} x(k)\frac{1}{3^{n-k}}$$

NO PROVARE CON $n=-10$

1) DIRE SE: STATICO (NO!), CAUSALE, LINEARE (SI), TEMPO INVARIANTE (NO)
2) RISPOSTA IMPULSIVA
3) BIBO STABILE?

$$y(n-n_0) = x(n-n_0-2) + \sum_{k=-\infty}^{-n+n_0-5} x(k)\frac{1}{3^{n-n_0-k}}$$

$$T[x(n-n_0)] = x(n-2-n_0) + \sum_{k=-\infty}^{-n-5} x(k-n_0)\frac{1}{3^{n-k}}$$

$$= x(n-2-n_0) + \sum_{m=-\infty}^{-n-n_0-5} x(m)\frac{1}{3^{n-m-n_0}}$$

$m = k-n_0$, $k = m+n_0$

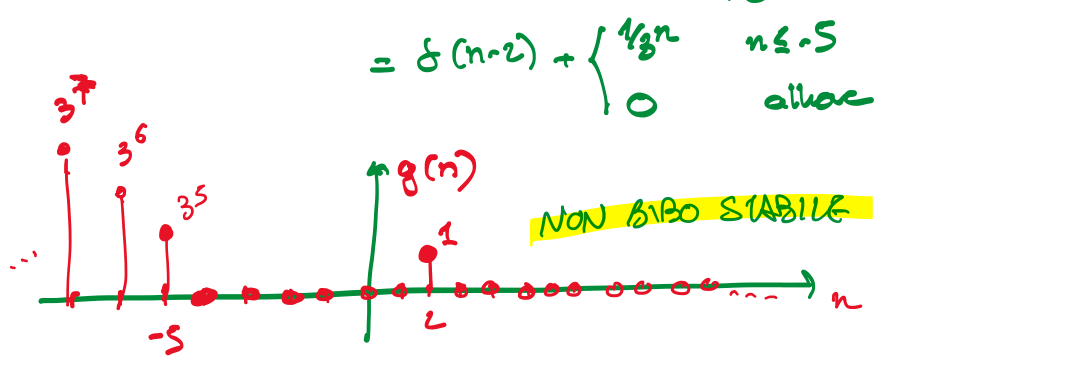
$$g(n) = T[\delta(n)] = \delta(n-2) + \sum_{k=-\infty}^{-n-5} \delta(k)\frac{1}{3^{n-k}}$$

$$= \delta(n-2) + \begin{cases} 1/3^n & \text{RANGE K INCLUDE 0} \\ 0 & \text{RANGE K NON INCLUDE 0}\end{cases}$$

$-n-5 \geq 0$

$n \leq -5$

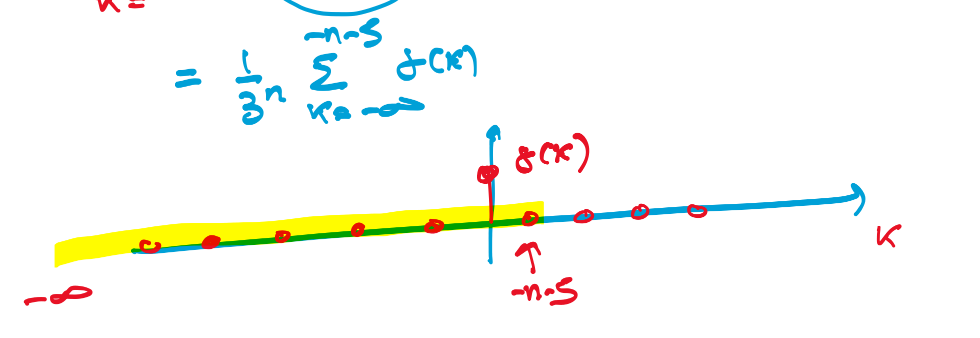
$$= \delta(n-2) + \begin{cases} 1/3^n & n \leq -5 \\ 0 & \text{altrove}\end{cases}$$



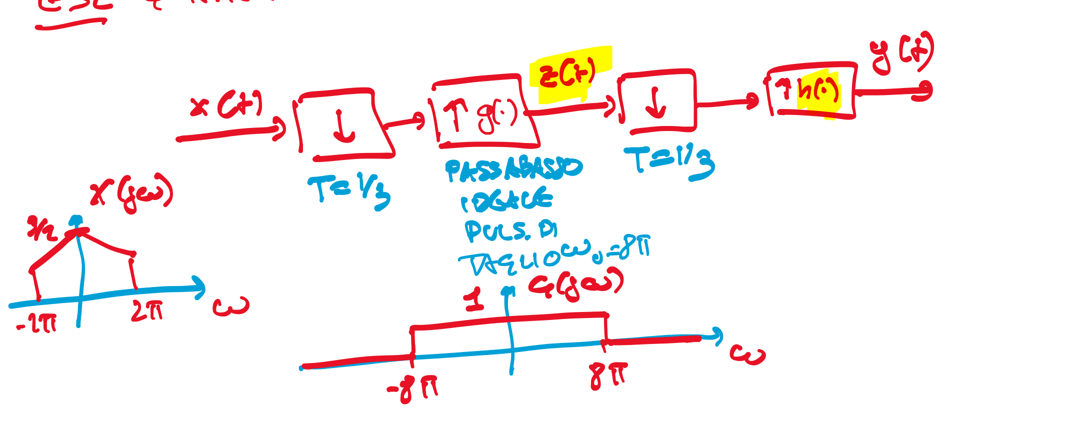
NON BIBO STABILE

$$\sum_{k=-\infty}^{-n-5} \delta(k)\frac{1}{3^{n-k}} \Rightarrow \delta(k)\frac{1}{3^n}$$

$$= \frac{1}{3^n}\sum_{k=-\infty}^{-n-5}\delta(k)$$



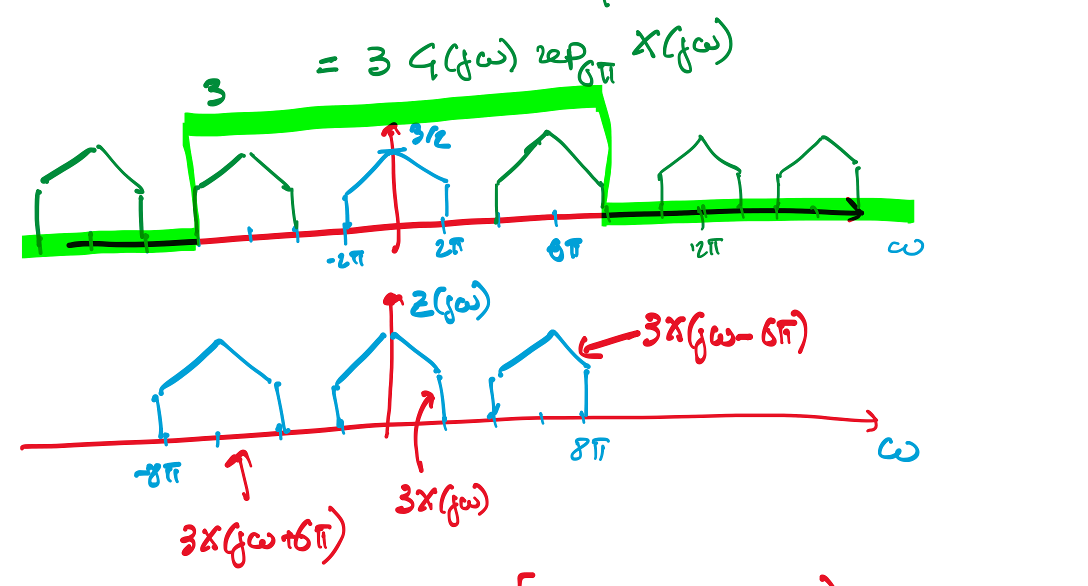
Es2 4° APPELLO 10/2/2022



1) $Z(j\omega) = ?$
2) TROVARE $h(t)$ CHE ASSICURI $y(t) = x(t)$

$$Z(j\omega) = \frac{1}{T} G(j\omega)\, rep_{\frac{2\pi}{T}} X(j\omega)$$

$$= 3\, G(j\omega)\, rep_{6\pi} X(j\omega)$$



$$Z(j\omega) = 3\left[X(j\omega) + X(j\omega-6\pi) + X(j\omega+6\pi)\right]$$

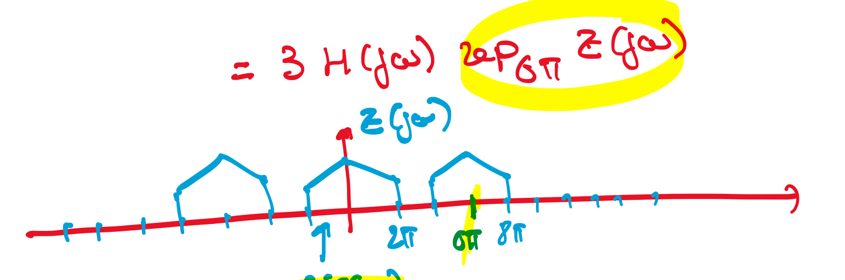
$\mathcal{F}^{-1}$ ↓

$$z(t) = 3\left[x(t) + x(t)e^{j6\pi t} + x(t)e^{-j6\pi t}\right]$$

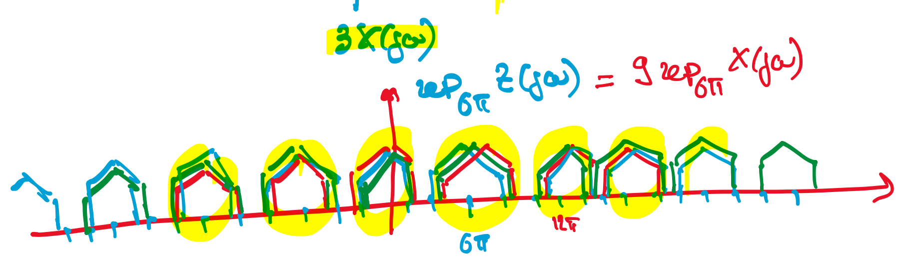
$$= 3\,x(t)\left[1 + 2\cos(6\pi t)\right]$$

$$Y(j\omega) = \frac{1}{T} H(j\omega)\, rep_{\frac{2\pi}{T}} Z(j\omega)$$

$$= 3\,H(j\omega)\, rep_{6\pi} Z(j\omega)$$



$$rep_{6\pi} Z(j\omega) = 9\, rep_{6\pi} X(j\omega)$$



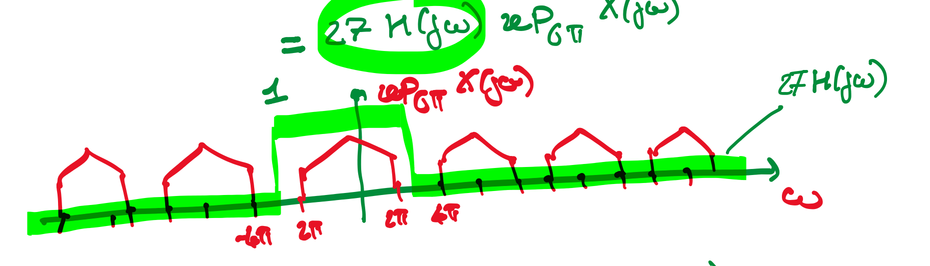
$$rep_{6\pi} Z(j\omega) = rep_{6\pi}\left[3X(j\omega) + 3X(j\omega-6\pi) + 3X(j\omega+6\pi)\right]$$

$$= rep_{6\pi}\, 3X(j\omega) + rep_{6\pi}\, 3X(j\omega-6\pi) + rep_{6\pi}\, 3X(j\omega+6\pi)$$

$$= 9\, rep_{6\pi} X(j\omega)$$

$$Y(j\omega) = 3\,H(j\omega)\, rep_{6\pi} Z(j\omega)$$

$$= 27\,H(j\omega)\, rep_{6\pi} X(j\omega)$$



$$27\,H(j\omega) = rect\left(\frac{\omega}{6\pi}\right)$$

$$H(j\omega) = \frac{1}{27} rect\left(\frac{\omega}{6\pi}\right)$$

$$= \frac{1}{9}\cdot\frac{1}{3} rect\left(\frac{1}{3}\frac{\omega}{2\pi}\right)$$

$$h(t) = \frac{1}{9}\, sinc(3t)$$

Es3

$$X(j\omega) = \frac{\sin(3\omega)}{3\omega}\cdot 3 + j\,\omega^2\cos(2\omega)$$

($sinc\left(\frac{3\omega}{\pi}\right)$)

1) $x(t)$ È IMMAGINARIO? NO → $X(j\omega)$ SIMM. ANTIHERMITIANA → PARTE REALE DISPARI ✗ / PARTE IMMAGINARIA PARI ✓
2) $A_x = ?$

$$A_x = X(j0) = 3 + j\cdot 0 = 3$$

Es4 TERZO APPELLO 7/9/2021

$$H(z) = \frac{1}{(z^{-2}+1)(z^{-1}+3)} = \frac{1}{(z^{-1}+j)(z^{-1}-j)(z^{-1}+3)}$$

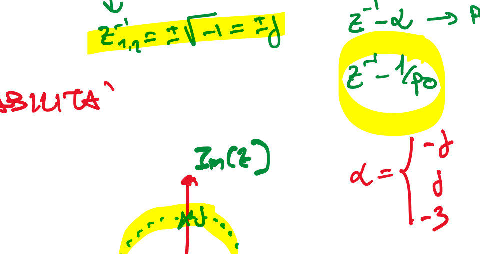
$z_{1,2}^{-1} = \pm\sqrt{-1} = \pm j$

$z^{-1} - \alpha \rightarrow$ polo $z = \frac{1}{\alpha}$

$z^{-1} - 1/p_0$

$\alpha = \begin{cases} -j \\ j \\ -3 \end{cases}$ $\quad p_i = \frac{1}{\alpha} = \begin{cases} j \\ -j \\ -\frac{1}{3}\end{cases}$

① POLI
② BIBO STABILITÀ



2 POLI SUL CERCHIO DI RAGGIO UNITARIO → NON BIBO STABILE

$$H(z) = \frac{R_0}{z^{-1}+j} + \frac{R_1}{z^{-1}-j} + \frac{R_2}{z^{-1}+3}$$

$$h(n) = -R_0\, j^{n+1} 1_0(n) - R_1 (-j)^{n+1} 1_0(n) - R_2\left(-\frac{1}{3}\right)^{n+1} 1_0(n)$$

non si spengono!!! — SI SPEGNE

$$-p_0^{n+1} 1_0(n) \xrightarrow{Z} \frac{1}{z^{-1}-\frac{1}{p_0}}$$

3) IDENTIFICARE UN INGRESSO $x(n)$ CHE DIA UN'USCITA NON LIMITATA

$$(n+1)p_0^{n+2} 1_0(n) \xrightarrow{Z} \frac{1}{\left(z^{-1}-\frac{1}{p_0}\right)^2}$$

$$X(z) = \frac{1}{z^{-1}+j} \qquad x(n) = -(-j)^{n+1} 1_0(n)$$

$$Y_f(z) = X(z)H(z) = \frac{1}{(z^{-1}+j)^2(z^{-1}-j)(z^{-1}+3)}$$

$$= \frac{R_0}{(z^{-1}+j)^2} + \frac{R_1}{(z^{-1}+j)} + \frac{R_2}{z^{-1}-j} + \frac{R_3}{z^{-1}+3}$$

$(n+1)\, j^{n+2} 1_0(n)$