AFTER 2. MI

(7) $y(n) = e^{-2n} u(n) + 2$

→ linearan za $2=0$

→ vrem. nepromjenjiv za $2=0$

→ bezmemorijski

→ kauzalan

⑦ $y(n) = e^{2n} u(n) + 1$

-> linearan za $1 = 0$

-> vrem. nepromjenjiv za $1 = 0$

-> bezmemorijski

-> kauzalan

⑧ $y(t) = e^{3t} u(t+1) u(t)$

-> za memoriju nas zanima samo pobuda

-> t van pobude ili t^2 unutar pobude, onda je vrem. promjenjiv
(potencija)

-> samo $u(t)$ puta nešto je linearno ($y(t) = f(t) u(t)$)

⑨ $u_1(n) = \delta(n) \rightarrow y_1(n) = h(n)$

$u_2(n) = u(n-1) \rightarrow y_2(n) = (n-1) h(n) \rightarrow$ BIBO nestabilan

$u_3(n) = u(n) \rightarrow y_3(n) = h(n)$

ograničenje po amplitudi

za memoriju nos [illegible]

→ t van zagrade ili t^2 (potencija) unutar zagrade, onda je vrem. promjenjiv

→ samo $u(t)$ puta nešto je linearno ($y(t) = h(t)\,u(t)$)

(9) $u_1(n) = \delta(n) \rightarrow y_1(n) = h(n)$

$u_2(n) = \mu(n-1) \rightarrow y_2(n) = (n-1)\,h(n) \rightarrow$ BIBO nestabilan

$u_3(n) = \mu(n) \rightarrow y_3(n) = h(n)$ ograničenje po amplitudi

$h(n) > 1, \quad n \geq 0$

$\delta(n) = \mu(n) - \mu(n-1)$

$S(\mu(n) - \mu(n-1)) = S(\mu(n)) - S(\mu(n-1)) = 2h(n) - nh(n)$

→ ne smije dati isti odziv na 2 razl. pobude (nelinearan)

(10) $\delta(n) = \mu(n) - \mu(n-1)$

$S(\mu(n)) = y_1(n)$

$\lambda(n) = 1, \quad n \geq 0$

$\delta(n) = \mu(n) - \mu(n-1)$

$S(\mu(n) - \mu(n-1)) = S(\mu(n)) - S(\mu(n-1)) = 2\lambda(n) - n\lambda(n)$

→ ne smije dati isti odziv na 2 razl. pobude (nelinearan)

(10) $\delta(n) = \mu(n) - \mu(n-1)$

$$\left.\begin{aligned} S(\mu(n)) &= y_1(n) \\ S(\mu(n-1)) &= y_1(n-1) \end{aligned}\right\} \quad S(\mu(n) - \mu(n-1)) = y_1(n) - y_1(n-1)$$

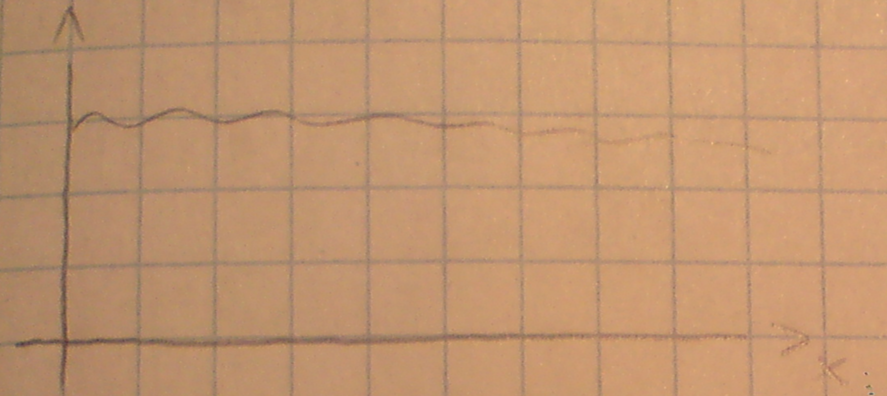
$$S(3\delta(n)) = 3(y_1(n) - y_1(n-1)) = 3 \cdot 6 = 18\mu(n-1)$$

$$y_1(n) = 6n\mu(n) = \begin{cases} 6n, & n \geq 1 \\ 0, & \text{inače} \end{cases}$$

$$y_1(n-1) = 6(n-1)\mu(n-1) = \begin{cases} 6(n-1), & n \geq 1 \\ 0, & \text{inače} \end{cases}$$

$$= 6n - 6n + 6 = 6, \quad n \geq 1$$

(11)



BIBO STABILAN

(12) $\delta(n+2) * 2^n = 2^{n+2}$

$2^{n+2} \cdot \delta(3n-6) = 2^4\, \delta(3n-6) = 16\, \delta(3n-6)$

$n_0 = 2$

(13) $x_1(n) = \{\underline{1}, 2\}$ $\quad x_1(n-1) \to$ pretp. za prve članove

$x_2(n) = \{\underline{1}, 1, 1\}$ $\quad x_2(n+1)$

(12) $\delta(n+4) * 2^{\ldots}$

$$2^{n+2}\cdot\delta(\underset{n_0=2}{3n-6}) = 2^4\,\delta(3n-6) = 16\,\delta(3n-6)$$

(13) $x_1(n) = \{\underline{1}, 2\}$ $x_1(n-1) \rightarrow$ pretp. za prve članove

$x_2(n) = \{\underline{1}, 1, 1\}$ $x_2(n+1)$

	1	1	1
1	1	1	1
2	2	2	2

$\{\underline{1}, 3, 3, 2\} = y(n) = x_1(n) * x_2(n)$

$x_1(n-1) * x_2(n+1) = y(n-1+1) = y(n)$

$\delta(n) + 3\delta(n-1) + 3\delta(n-2) + 2\delta(n-3)$

(16) $y(n) - 2y(n-1) + y(n-2) = u(n)$

$y(-1) = y(-2) = 0$ (MIRNI SUSTAV)

$\delta(n) + 3\delta(n-1) + 3\delta(n-2) + 2\delta(n-3)$

16. $y(n) - 2y(n-1) + y(n-2) = \mu(n)$

$y(-1) = y(-2) = 0$ (MIRNI SUSTAV)

$\mu(n) = \delta(n)$

$q^2 - 2q + 1 = 0$

$q_{1,2} = 1$

$y_h(n) = (C_1 + C_2 n) 1^n$

$y(n) = \mu(n) + 2y(n-1) - y(n-2)$

$y(0) = \mu(0) + 2y(-1) - y(-2) = 1$

$y(1) = \mu(1) + 2y(0) - y(-1) = 2$

$h(0) = C_1 = 1$

$h(1) = 1 + C_2 = 2 \rightarrow C_2 = 1$

$h(n) = (n+1)\mu(n)$

17) $u(n) = 4\mu(n)$

$y(0) \doteq u(0) + 2y(-1) - y(-2) = 4$

$y(1) = u(1) + 2y(0) - y(-2) = 4 + 8 = 12$

$y_h(n) = (C_1 + C_2 n) 1^n, \quad q_{1,2} = 1$

$y_p = K(1)^n n^2 = Kn^2$

$y_p(n) - 2y_p(n-1) + y_p(n-2) = u(n)$

$Kn^2 - 2K(n^2 - 2n + 1) + K(n^2 - 4n + 4) = 4\mu(n)$

$2K = 4 \rightarrow K = 2$

$y_p = 2n^2$

$y_m(n) = y_h(n) + y_p(n) = C_1 + C_2 n + 2n^2, \quad n \geq 0$

$y_h(0) = C_1 = 4$

$y_h(1) = 4 + C_2 + 2 = 12 \rightarrow C_2 = 6$

$y_h(n) = (4 + 6n + 2n^2)\mu(n)$

18) $y(n) + \frac{1}{3} y(n-1) = u(n-1)$

$u(n) = 10 \sin\left(n\frac{\pi}{2}\right) \rightarrow u(n-1) = 10 \sin\left(n\frac{\pi}{2} - \frac{\pi}{2}\right)$

$y_h(0) = C_1 = 4$

$y_h(1) = 4 + C_2 + 2 = 12 \to C_2 = 6$

$y_h(n) = (4 + 6n + 2n^2)\,u(n)$

(12) $y(n) + \frac{1}{3} y(n-1) = u(n-1)$

$u(n) = 10 \sin\left(n\frac{\pi}{2}\right) \to u(n-1) = 10 \sin\left(n\frac{\pi}{2} - \frac{\pi}{2}\right) = -10 \cos\left(n\frac{\pi}{2}\right)$

$y_p(n) = K_1 \sin\left(n\frac{\pi}{2}\right) + K_2 \cos\left(n\frac{\pi}{2}\right)$

$K_1 \sin\left(n\frac{\pi}{2}\right) + K_2 \cos\left(n\frac{\pi}{2}\right) + \frac{1}{3} K_1 \sin\left(n\frac{\pi}{2} - \frac{\pi}{2}\right) + \frac{1}{3} K_2 \cos\left(n\frac{\pi}{2} - \frac{\pi}{2}\right) = -10 \cos\left(n\frac{\pi}{2}\right)$

$K_1 \sin\left(n\frac{\pi}{2}\right) + K_2 \cos\left(n\frac{\pi}{2}\right) - \frac{1}{3} K_1 \cos\left(n\frac{\pi}{2}\right) + \frac{1}{3} K_2 \sin\left(n\frac{\pi}{2}\right) = -10 \cos\left(n\frac{\pi}{2}\right)$

$\left(K_1 + \frac{1}{3} K_2\right) \sin\left(n\frac{\pi}{2}\right) + \left(K_2 - \frac{1}{3} K_1\right) \cos\left(n\frac{\pi}{2}\right) = -10 \cos\left(n\frac{\pi}{2}\right)$

$K_1 + \frac{1}{3} K_2 = 0 \qquad 3K_1 = -K_2$

$K_2 - \frac{1}{3} K_1 = -10 \to -K_1 + 3K_2 = 30$

$K_2 = -9 \quad K_1 = 3$

$y_p(n) = 3 \sin\left(n\frac{\pi}{2}\right) - 9 \cos\left(n\frac{\pi}{2}\right)$

(19) $y(-1) = -39$

$y(0) = u(-1) - \frac{1}{3} y(-1) = -10 + 13 = 3$

$y_h(n) = C_1 \cdot \left(\frac{1}{3}\right)^n$

$y_t(n) = C_1 \left(\frac{1}{3}\right)^n + 3 \sin\left(n \frac{\pi}{2}\right) - 9 \cos\left(n \frac{\pi}{2}\right)$

$y_t(0) = C_1 - 9 = 3 \Rightarrow C_1 = 12$

$y_t(0) = \underbrace{12\left(-\frac{1}{3}\right)^n}_{\text{prirodni}} + \underbrace{3 \sin\left(n \frac{\pi}{2}\right) - 9 \cos\left(n \frac{\pi}{2}\right)}_{\text{prisilni}}$

(20) $y(n) + \frac{1}{3} y(n-1) = u(n)$

$\begin{cases} 1, & 0 \leq n \leq 9 \end{cases}$

(20) $y(n)+\frac{1}{3}y(n-1)=u(n)$

$$u(n)=\mu(n)-\mu(n-10)=\begin{cases}1, & 0\le n\le 9\\ 0, & \text{inače}\end{cases}$$

$n=154$

$y(-1)=0$

$y_h(n)=C_1\left(\frac{1}{3}\right)^n$

$y_p(n)=K_1\ ,\ 0\le n\le 9$

$K+\frac{1}{3}K=1 \rightarrow K=\frac{3}{4}$

$y_p(n)=\frac{3}{4}\ ,\ 0\le n\le 9$

$$y_t(n) = C_1\left(-\frac{1}{3}\right)^n + \frac{3}{4}, \quad 0 \leq n \leq 9$$

$$y(0) = u(0) - \frac{1}{3}y(-1) = 1$$

$$y_t(0) = C_1 + \frac{3}{4} = 1 \rightarrow C_1 = \frac{1}{4}$$

$$y_t(n) = \frac{1}{4}\left(\left(-\frac{1}{3}\right)^n + 3\right)$$

$$y_t(9) = \frac{1}{4}\left(-3^{-9} + 3\right)$$

$$y(10) = u(t) - \frac{1}{3}y(9) = \frac{1}{4}\left(3^{-10} - 1\right)$$

$$y_t(n) = C_1\left(\frac{1}{3}\right)^n, \quad n \geq 10$$

$$y_t(10) = C_1 3^{-10} = \frac{1}{4}\left(3^{-10} - 1\right)$$

$$C_1 = \frac{1}{4}\left(1 - 3^{10}\right)$$

$$y_t(n) = \frac{1}{4}\left(1 - 3^{10}\right)\left(-\frac{1}{3}\right)^n, \quad n \geq 0$$

$$y_t(154) = \frac{1}{4}\left(3^{-154} - 3^{-144}\right)$$

3) $\omega_s = 5 \rightarrow T_s = \frac{2\pi}{5}$

$y(n) = 2\cos\left(\frac{8\pi}{5}n\right) = 2\cos\left(-\frac{2\pi}{5}n\right) = 2\cos\left(\frac{2\pi}{5}n\right) \rightarrow \omega_c = \frac{\omega_d}{T_s} = \frac{\frac{2\pi}{5}}{\frac{2\pi}{5}} = 1$

$= 2\cos(t)$

5) $x(t) = 1 + \sin(10\pi t)$

$f_s = 20\,Hz \rightarrow T_s = 50\,ms$

$x(0) = 1 + \sin(0) = 1$

$x(0.05) = 1 + \sin\left(\frac{\pi}{2}\right) = 2$

$x(0.1) = 1 + \sin(\pi) = 1$

$= 2\cos(t)$

(5) $x(t) = 1 + \sin(10\pi t)$

$f_s = 20\,Hz \rightarrow T_s = 50\,ms$

$x(0) = 1 + \sin(0) = 1$

$x(0.05) = 1 + \sin\left(\frac{\pi}{2}\right) = 2$

$x(0.1) = 1 + \sin(\pi) = 1$

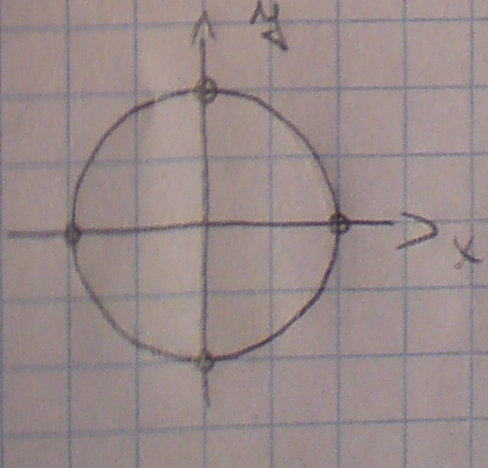
$x(0.15) = 1 + \sin\left(\frac{3\pi}{2}\right) = 0$

$x(n) = \{\underline{1}, 2, 1, 0\}$

$$X_k = \sum_{n=0}^{3} x(n) e^{-j\frac{2\pi}{N}kn} = x(0) + x(1) e^{-j\frac{\pi}{2}k} + x(2) e^{-j\pi k}$$

$\omega_s = 40\pi$

$\frac{40\pi}{4} = 10\pi$



$X(1) = -2j$