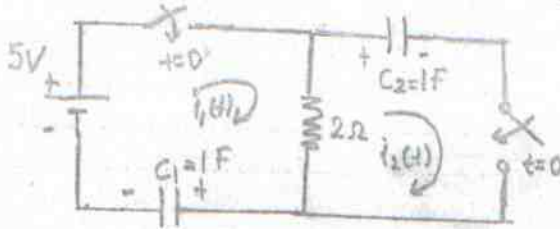




Adı Soyadı		1	2	3	Toplam
Numara					

- $x(t) = (1/2)t^2 u(t-1)$ ise $X(s)$ Laplace dönüşümünü bulunuz.
- $a) H(s) = \frac{K(s-1)}{s^2 + (K+2)s + 2-K}$ ile verilen nedensel DZD bir sisteme ait transfer fonksiyonun kararlı olması için gerekli K aralığını belirleyiniz.
- Aşağıdaki şekildeki devrede iki anahtar $t=0$ anında kapatılıyor. C_1 ve C_2 kondansatörlerin gerilimi anahtar açılmadan önce sırasıyla 1 ve 2 V'tur.
 - $i_1(t)$ ve $i_2(t)$ akımlarını bulunuz.
 - Kondansatör gerilimlerinin $t=0^+$ 'daki değerlerini bulunuz.



Yrd. Doç. Dr. Selda GÜNEY

Başarılar...

CEVAPLAR

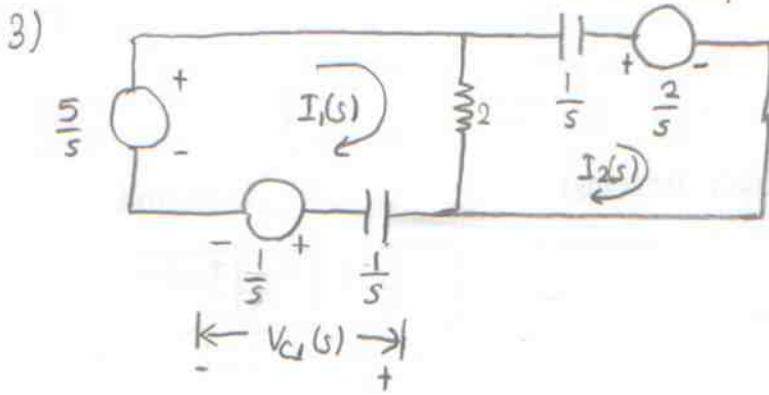
$$\begin{aligned}
 1) \quad \frac{1}{2} t^2 u(t-1) &= \left(\frac{1}{2} (t-1)^2 + (t-1) + \frac{1}{2} \right) u(t-1) \\
 &= \left(\frac{1}{2} (t-1)^2 + (t-1) + \frac{1}{2} \right) u(t-1) \\
 &= \frac{1}{2} (t-1)^2 u(t-1) + (t-1) u(t-1) + \frac{1}{2} u(t-1) \\
 \mathcal{L}\{f(t)\} &= \frac{e^{-s}}{s^3} + \frac{e^{-s}}{s^2} + \frac{e^{-s}}{2s} \quad \text{Re}(s) > 0
 \end{aligned}$$

$$2) \quad H(s) = \frac{K(s-1)}{s^2 + (K+2)s + 2-K}$$

$$\begin{aligned}
 1. \text{ koşul} \quad & K+2 > 0 \quad K > -2 \\
 & 2-K > 0 \quad K < 2
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ koşul} \quad & \begin{array}{c|cc} s^2 & 1 & 2-K \\ s^1 & K+2 & 0 \\ s^0 & 2-K & \end{array} \Rightarrow \begin{array}{l} K+2 > 0 \\ 2-K > 0 \end{array}
 \end{aligned}$$

$$-2 < K < 2$$



a) $2I_1(s) + \frac{1}{s}I_1(s) - 2I_2(s) + \frac{1}{s} - \frac{5}{s} = 0$

$$\left(2 + \frac{1}{s}\right)I_1(s) - 2I_2(s) = \frac{4}{s}$$

$$-2I_1(s) + 2I_2(s) + \frac{1}{s}I_2(s) + \frac{2}{s} = 0$$

$$-2I_1(s) + \left(2 + \frac{1}{s}\right)I_2(s) = -\frac{2}{s}$$

$$I_1(s) = \frac{s+1}{s+\frac{1}{4}} = \frac{s+\frac{1}{4}+\frac{3}{4}}{s+\frac{1}{4}} = 1 + \frac{3}{4} \frac{1}{s+\frac{1}{4}}$$

$$I_2(s) = \frac{s-\frac{1}{2}}{s+\frac{1}{4}} = \frac{s+\frac{1}{4}-\frac{3}{4}}{s+\frac{1}{4}} = 1 - \frac{3}{4} \frac{1}{s+\frac{1}{4}}$$

$$i_1(t) = \delta(t) + \frac{3}{4} e^{-t/4} u(t)$$

$$i_2(t) = \delta(t) - \frac{3}{4} e^{-t/4} u(t)$$

b) $V_{c1}(s) = \frac{1}{s}I_1(s) + \frac{1}{s}$

$$V_{c2}(s) = \frac{1}{s}I_2(s) + \frac{2}{s}$$

$$V_{c1}(s) = \frac{1}{s} \frac{s+1}{s+\frac{1}{4}} + \frac{1}{s}$$

$$V_{c2}(s) = \frac{1}{s} \frac{s-\frac{1}{2}}{s+\frac{1}{4}} + \frac{2}{s}$$

ilk deger teoremini kullanarak

$$V_{c1}(0^+) = \lim_{s \rightarrow \infty} s V_{c1}(s) = \lim_{s \rightarrow \infty} \frac{s+1}{s+\frac{1}{4}} + 1 = 1+1 = 2 \text{ V}$$

$$V_{c2}(0^+) = \lim_{s \rightarrow \infty} s V_{c2}(s) = \lim_{s \rightarrow \infty} \frac{s-\frac{1}{2}}{s+\frac{1}{4}} + 2 = 1+2 = 3 \text{ V}$$

① $3y[n] - 4y[n-1] + y[n-2] = x[n]$; $x[n] = (\frac{1}{2})^n$ $y[-1] = 1$ $y[-2] = 2$
 $y[n] = ?$

$$3Y_1(z) - 4\{z^{-1}Y_1(z) + y[-1]\} + \{z^{-2}Y_1(z) + z^{-1}y[-1] + y[-2]\} = X_1(z)$$

$$Y_1(z) \cdot (3 - 4z^{-1} + z^{-2}) = 2 - z^{-1} + \frac{z}{2}$$

$$Y_1(z) = \frac{3(z-1)(z-\frac{1}{3})}{z^2} = \frac{3z^2 - 2z + \frac{1}{2}}{z(z-\frac{1}{2})}$$

$$Y_1(z) = \frac{2(3z^2 - 2z + \frac{1}{2})}{3(z-1)(z-\frac{1}{2})(z-\frac{1}{3})}$$

(30)

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

$$y[n] = \left(\frac{3}{2} - \left(\frac{1}{2}\right)^n + \frac{1}{2} \left(\frac{1}{3}\right)^n \right) u[n]$$

② $x(t) = \delta(t+1) + 3e^{-2t}u(t) - 8e^{-3t}u(t)$

$$X(s) = 1 + \frac{3}{s+2} - \frac{8}{s+3} = \frac{(s+2)(s+3) + 3(s+3) - 8(s+2)}{(s+2)(s+3)}$$

$$= \frac{s^2 + 5s + 6 + 3s + 9 - 8s - 16}{(s+2)(s+3)} = \frac{(s+1)(s-1)}{(s+2)(s+3)}$$

$$H(s) = \frac{Y(s)}{X(s)} = \frac{\frac{(s-1)(s+2)}{(s+4)(s+3)}}{\frac{(s+1)(s-1)}{(s+2)(s+3)}} = \frac{(s+2)^2}{(s+1)(s+4)}$$

(10)

$$H(j\omega) = \frac{(j\omega+2)^2}{(j\omega+1)(j\omega+4)} = \frac{\frac{1}{4}(j\omega+2)^2}{\frac{1}{4}(j\omega+1)(j\omega+4)} = \frac{(\frac{j\omega}{2}+1)^2}{(\frac{j\omega}{4}+1)(j\omega+1)}$$

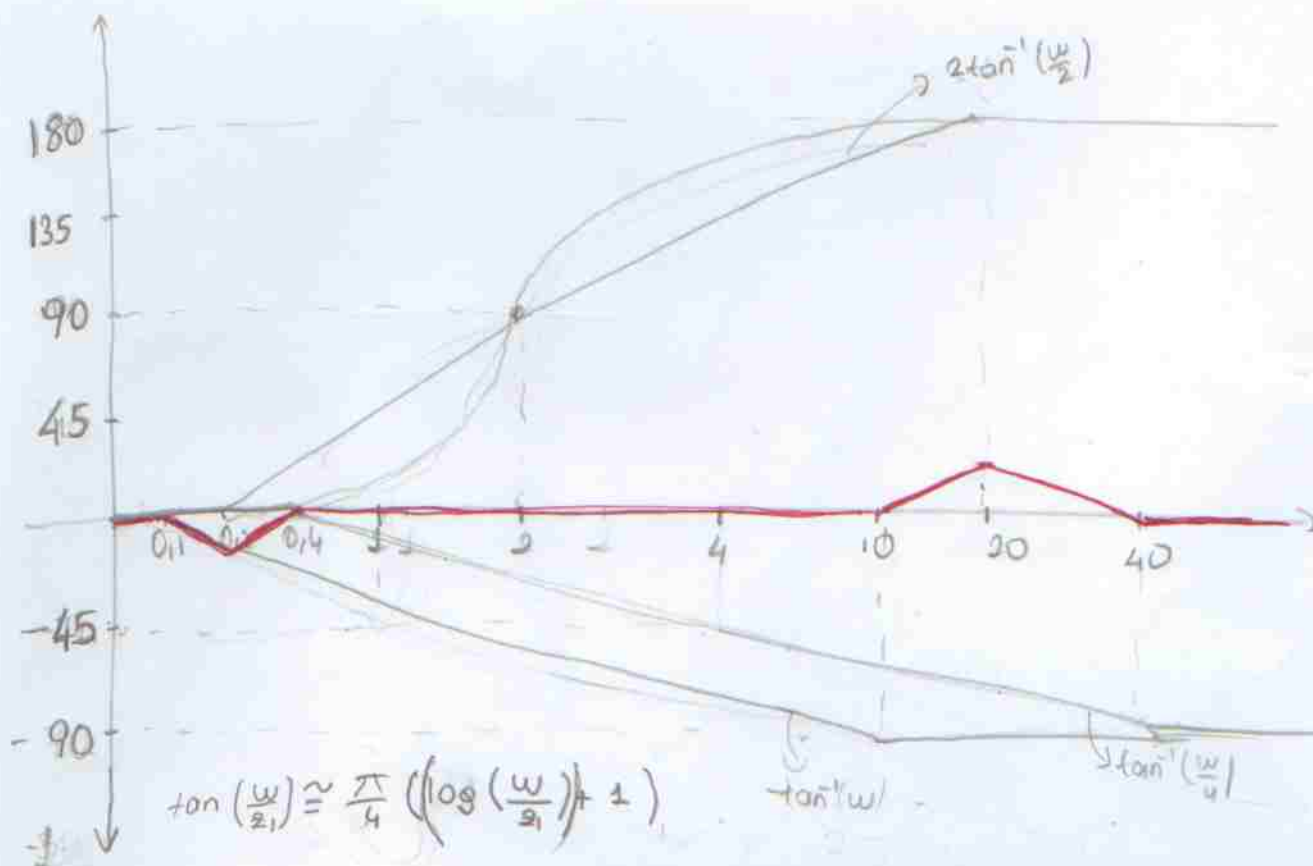
$$20 \log |H(j\omega)| = 40 \log |1 + \frac{j\omega}{2}| - 20 \log |1 + j\omega| - 20 \log |1 + \frac{j\omega}{4}|$$

kırılma frekans.

$\omega_1 = 2$

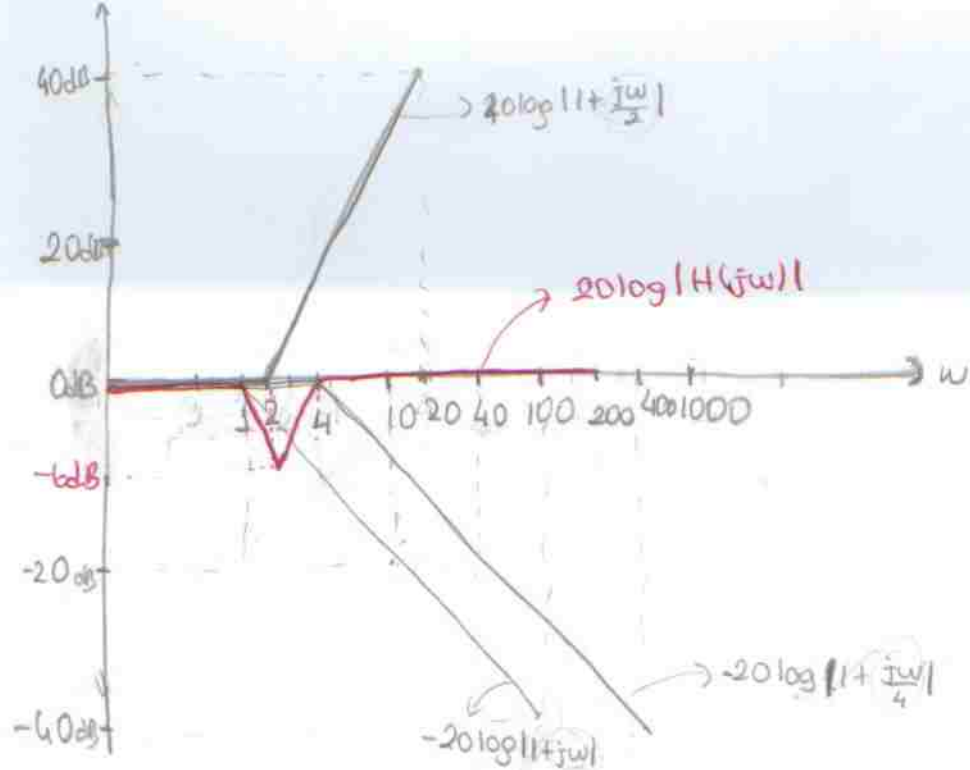
$\omega_2 = 1$

$\omega_3 = 4$



(15)

	$2 \tan^{-1}(\frac{w}{2})$	$-\tan^{-1}(\frac{w}{4})$	$-\tan^{-1}(w)$	
	$ \frac{\pi}{2}(\log(\frac{w}{2})+1) $	$-\frac{\pi}{4}(\log(\frac{w}{4})+1)$	$-\frac{\pi}{4}(\log(w)+1)$	
$w=0,1$	0°	0°	0	0°
$w=0,2$	0°	0°	$-13,5^\circ$	$-13,5^\circ$
$w=0,4$	$22,7^\circ$	0	-27°	0°
$w=1$	63°	-18°	-45°	0°
$w=2$	90°	-31°	-59°	10°
$w=4$	117°	-45	-72°	0°
$w=10$	153°	-63°	-90°	0°
$w=20$	180°	-76°	-90°	14°
$w=40$	180°	-90°	-90°	0°



(15)

$$\omega=1 \quad 20 \log |H(j\omega)| = 0 - 0 - 0 = 0 \text{ dB}$$

$$\omega=2 \quad 20 \log |H(j\omega)| = 0 - 6 - 0 = -6 \text{ dB}$$

$$\omega=4 \quad 20 \log |H(j\omega)| = 12,04 - 12,04 - 0 = 0 \text{ dB}$$

$$\omega=10 \quad 20 \log |H(j\omega)| = 27,95 - 20 - 7,95 = 0 \text{ dB}$$

$$\omega=20 \quad 20 \log |H(j\omega)| = 40 - 26 - 14 = 0 \text{ dB}$$

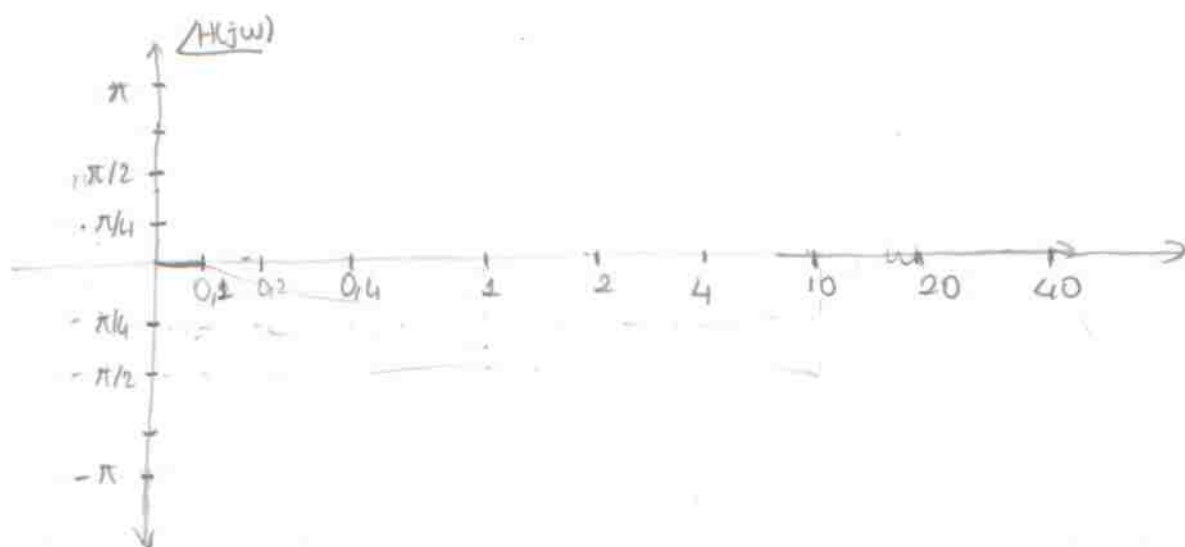
$$\omega=40 \quad 20 \log |H(j\omega)| = 52 - 32 - 20 = 0 \text{ dB}$$

$$\angle H(j\omega) = 2 \cdot \tan^{-1} \left(\frac{\omega}{2} \right) - \tan^{-1} \left(\frac{\omega}{4} \right) - \tan^{-1}(\omega)$$

$$\omega_1 = 2 \quad 0,2 \quad 20$$

$$\omega_2 = 1 \quad 0,1 \quad 10$$

$$\omega_3 = 4 \quad 0,4 \quad 40$$



$$\textcircled{3} \quad H(j\omega) = \prod_{n=1}^N \left(\frac{1 - nj\omega}{1 + nj\omega} \right)$$

$$|H(j\omega)| = \prod_{n=1}^N \frac{|1 - nj\omega|}{|1 + nj\omega|} = \prod_{n=1}^N \frac{\sqrt{1 + n^2\omega^2}}{\sqrt{1 + n^2\omega^2}} = \prod_{n=1}^N 1 = 1 \quad (15)$$

$$\angle H(j\omega) = \sum_{n=1}^N \tan^{-1}(n\omega) - \tan^{-1}(-n\omega) \quad (30)$$

$$= \sum_{n=1}^N 2 \tan^{-1}(n\omega)$$

$$\tau(\omega) = - \frac{d \angle H(j\omega)}{d\omega} = -2 \sum_{n=1}^N \frac{d(\tan^{-1}(n\omega))}{d\omega} = -2 \sum_{n=1}^N \frac{n}{(n\omega)^2 + 1} \quad (15)$$

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Cevapları

① $H_1(e^{j\omega}) = \frac{1}{(1 - \frac{1}{2}e^{-j\omega})(1 - \frac{1}{3}e^{-j\omega})(1 - \frac{1}{4}e^{-j\omega})}$

Birinci dereceden bir sistemde $\frac{1}{1 - ae^{-j\omega}}$ $a > 0$ ise salınımsız $a < 0$ ise salınlı

Tüm a'lar pozitif olduğu için salınımsızdır.

$H_2(e^{j\omega}) = \frac{1}{\underbrace{(1 + \frac{1}{2}e^{-j\omega})}_{a < 0} \underbrace{(1 - \frac{1}{3}e^{-j\omega})}_{a > 0} \underbrace{(1 - \frac{1}{4}e^{-j\omega})}_{a > 0}}$ Sistem salınlıdır.

$H_3(e^{j\omega}) = \frac{1}{\underbrace{(1 - \frac{1}{2}e^{-j\omega})}_{a > 0} (1 - \frac{3}{4}e^{-j\omega} + \frac{9}{16}e^{-j2\omega})}$

$r = \frac{3}{4} \quad \cos \theta = \frac{1}{2}$

$(1 - 2r \cos \theta e^{-j\omega} + r^2 e^{-j2\omega})$ - formatındadır

$\theta \neq 0$ olduğu için salınım etkisi göstermektedir.

② a) $Y(e^{j\omega}) = ba X(e^{j\omega})e^{-j\omega} + b X(e^{j\omega}) + ab X(e^{j\omega})e^{j\omega}$

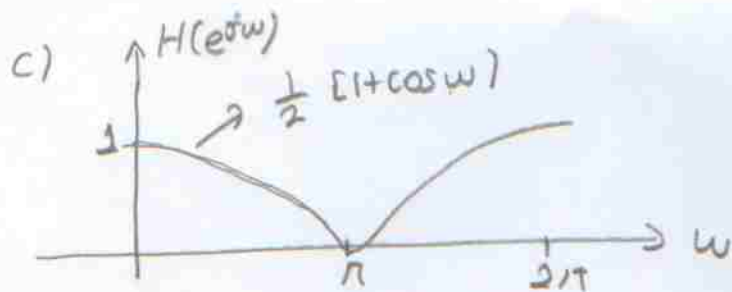
$\uparrow$ $y[n] = b \{ax[n-1] + x[n] + ax[n+1]\}$

$H(e^{j\omega}) = \frac{Y(e^{j\omega})}{X(e^{j\omega})} = ba e^{-j\omega} + b + ba e^{j\omega} = b + 2ab \cos \omega$

$H(e^{j\omega}) = b(1 + 2a \cos \omega)$

b) $H(e^{j0}) = b(1 + 2a) = 1 \quad b = \frac{1}{1 + 2a} //$

c) $a = \frac{1}{2} \quad b = \frac{1}{2} \quad H(e^{j\omega}) = \frac{1}{2}(1 + \cos \omega)$



3) a) $x_p[n] = \begin{cases} x[n], & n = 0, \pm 2, \pm 4 \\ 0, & n = \pm 1, \pm 3, \pm 5 \end{cases}$

$x_d[n] = x[2n]$

