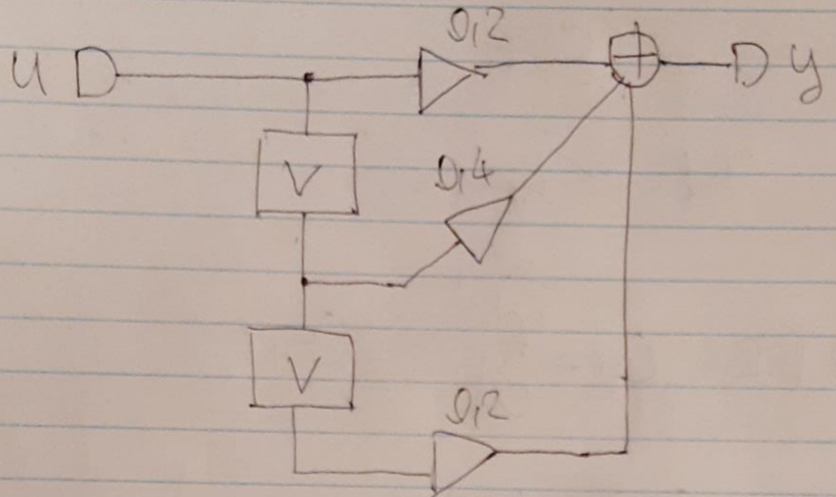
①

a) $H(z) = \dfrac{0{,}2 + 0{,}4z^{-1} + 0{,}2z^{-2}}{1}$

$h[k] = \mathcal{Z}^{-1}\{H(z)\} = 0{,}2\,\delta[k] + 0{,}4\,\delta[k-1] + 0{,}2\,\delta[k-2]$

b) $H(e^{j\vartheta}) = 0{,}2 + 0{,}4\,e^{-j\vartheta} + 0{,}2\,e^{-j2\vartheta}$

c)



d) FIR rendszer mivel
$h[k] = c_0\delta[k] + c_1\delta[k-1] + \dots + c_{L-1}\delta[k-(L-1)]$
tehát csak dirakimpulzusokból áll, szóval létezik olyan $k \geq L$ ütem ahol $h[k]=0$
(laikus magyarázat: beadsz neki egy dirakimpulzust és ha elég időt vársz a válasza 0 lesz)

e) $H(e^{j\vartheta}) = 0{,}2 + 0{,}4\,e^{-j\vartheta} + 0{,}2\,e^{-j2\vartheta} =$

$= e^{-j\vartheta}(0{,}2\,e^{j\vartheta} + 0{,}4 + 0{,}2\,e^{-j\vartheta}) = e^{-j\vartheta}[0{,}2(e^{j\vartheta} + e^{-j\vartheta}) + 0{,}4] =$

$= e^{-j\vartheta}[2 \cdot 0{,}2\cos(\vartheta) + 0{,}4]$

$H(\vartheta) = 0{,}4\cos(\vartheta) + 0{,}4$

$\varphi(\vartheta) = -\vartheta$

f)

$\vartheta = 0 \qquad U_0 = 1$

$$H(e^{j0}) = 0{,}2 + 0{,}4e^{-j0} + 0{,}2e^{-j\cdot 2\cdot 0} = 0{,}8$$

$$Y_0 = H(e^{j0}) \cdot U_0 = 0{,}8$$

$\vartheta = \frac{3\pi}{2} \qquad U_1 = 0{,}5e^{j\frac{\pi}{4}}$

$$H(e^{j\frac{3\pi}{2}}) = 0{,}2 + 0{,}4e^{-j\frac{3\pi}{2}} + 0{,}2e^{-j\cdot 3\pi} = 0{,}4j = 0{,}4e^{j\frac{\pi}{2}}$$

$$Y_1 = H(e^{j\frac{3\pi}{2}}) \cdot U_1 = 0{,}2e^{j\frac{3\pi}{4}} \Rightarrow 0{,}2\cos\left(\frac{3\pi}{2}k + \frac{3\pi}{4}\right)$$

$\vartheta = \pi$ nivel $0{,}2(-1)^k = 0{,}2\cos(\pi k)$

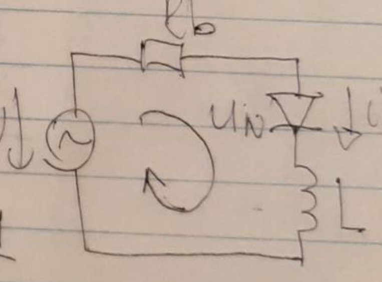
$$H(e^{j\pi}) = 0{,}2 + 0{,}4e^{-j\pi} + 0{,}2e^{-j2\pi} = 0$$

$$Y_2 = 0$$

$$y[k] = Y_0 + Y_1 + Y_2 = 0{,}8 + 0{,}2\cos\left(\frac{3\pi}{2}k + \frac{3\pi}{4}\right)$$

2

a)

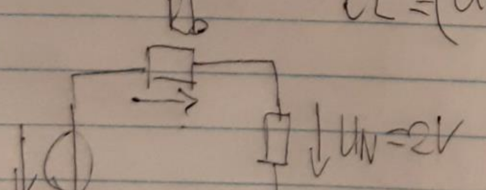


$i_N = i_L$

$0 = -U_S + i_L \cdot R_b + U_N + i_L' \cdot L$

$i_L' = (U_S + i_L R_b - U_N) \cdot \frac{1}{L}$

b)



$U_{Rb} = 4 - 2 = 2V$

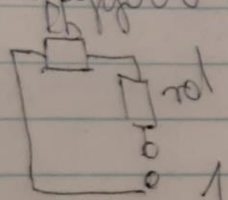
$R_b = \frac{U_{Rb}}{i_N} = \frac{2V}{2mA} = 1k\Omega$

c)

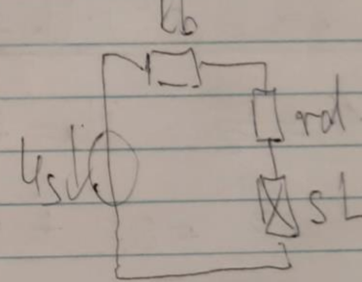
$$r_d = \frac{dU_N}{di_N} = \frac{1}{\frac{di_N}{dU_N}} = \frac{1}{2\cdot 0{,}5U_N} = \frac{1}{U_N} = \frac{1}{2}k\Omega$$

d)

Elsőrendű hálózatnál a dinamikus elem felől „benézve" meghatározzuk az eredő ell.-t és ha ez nagyobb mint 0 akkor stabil. (forrást dezaktiválzuk)



$R_b + r_d > 0$ stabil



e)

$$H(s) = \frac{1}{R_b + r_d + sL} = \frac{1}{1+0{,}5+s}$$

$$H(s) = \frac{1}{s+1{,}5}$$

$$U_0 = 4 \quad \omega = 0 \quad H(j0) = \frac{1}{1{,}5} = \frac{2}{3}$$

$$Y_0 = U_0 \cdot H(j0) = \frac{2}{3} \cdot 4 = \frac{8}{3}$$

$$U_1 = 0{,}2 \quad \omega = 1{,}5 \quad H(j1{,}5) = \frac{\sqrt{2}}{3} e^{-j\frac{\pi}{4}}$$

$$Y_1 = U_1 H(j1{,}5) = \frac{\sqrt{2}}{15} e^{-j\frac{\pi}{4}} \Rightarrow \frac{\sqrt{2}}{15} \cos\left(1{,}5t - \frac{\pi}{4}\right)$$

$$y(t) = \frac{8}{3} + \frac{\sqrt{2}}{15} \cos\left(1{,}5t - \frac{\pi}{4}\right)$$