NUMERO: 907 DATA: 12/03/2014

A P P U N T I

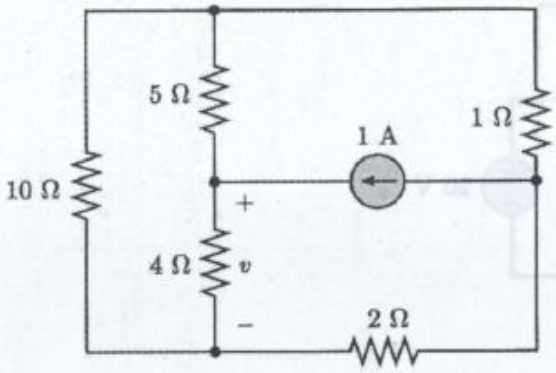
STUDENTE: Vanelli

MATERIA: Elettrotecnica Eserc.

Prof. Lombardi

Esercizio 3.1

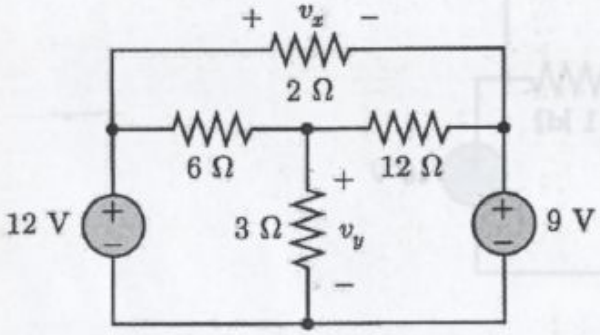
Ricavare la tensione v, mediante l'analisi nodale.



$V_A = 2{,}041$

Esercizio 3.2

Calcolare v_x e v_y mediante l'analisi nodale

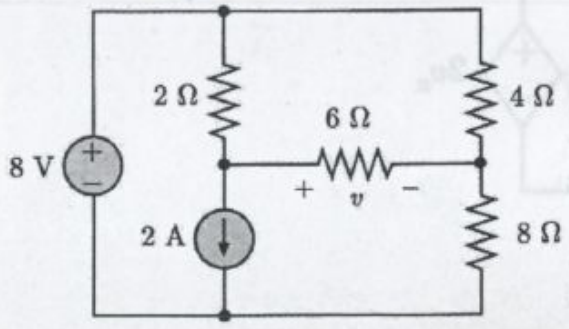


$V_x = 3V$

$V_y = 4{,}71\,V$

Esercizio 3.3

Calcolare v con il metodo ai nodi



$V = -0{,}75V$

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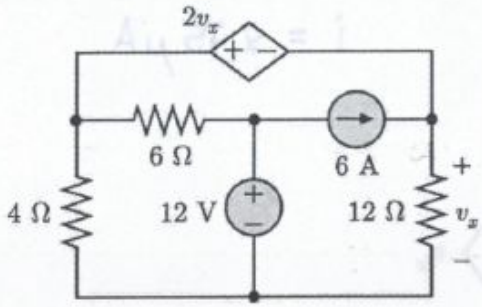
Esercizio 3.7

Calcolare v_x mediante l'analisi nodale

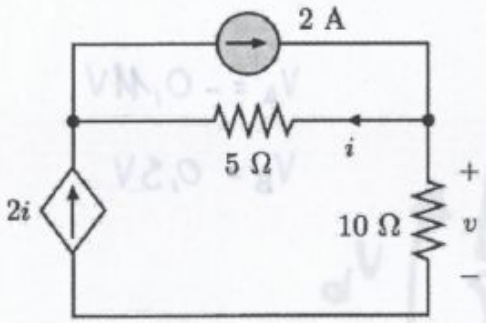
$V_x = 13,5\ V$



Esercizio 3.8

Calcolare v con il metodo ai nodi

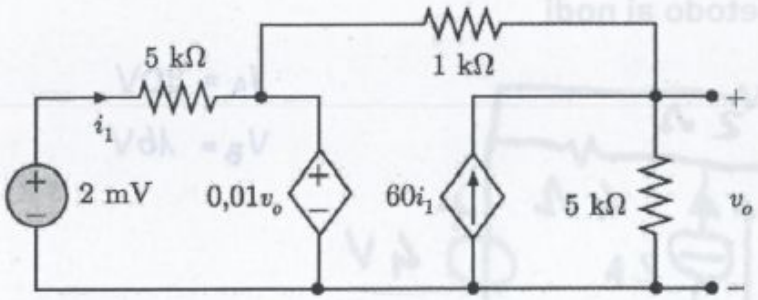
$V = 13,33V$



Esercizio 3.9

Calcolare vo con il metodo ai nodi

$V_0 = 18.32$



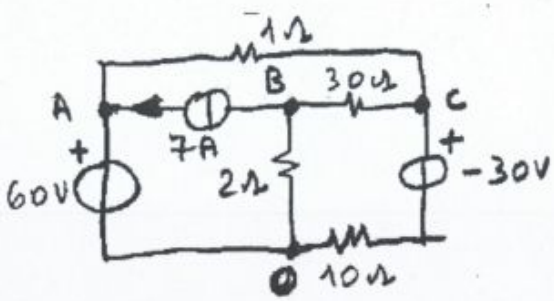
Esercizio 3.13

Calcolare V_{AO}, V_{BO} e V_{CO} con il metodo ai nodi

$V_{AO} = 60V$

$V_{BO} = -10V$

$V_{CO} = 50V$



Esercizio 3.14

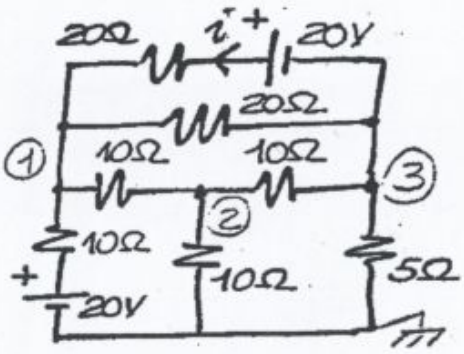
Calcolare le tensioni nodali e la corrente i

$V_1 = \frac{145}{12} V$

$V_2 = \frac{55}{12} V$

$V_3 = \frac{5}{3} V$

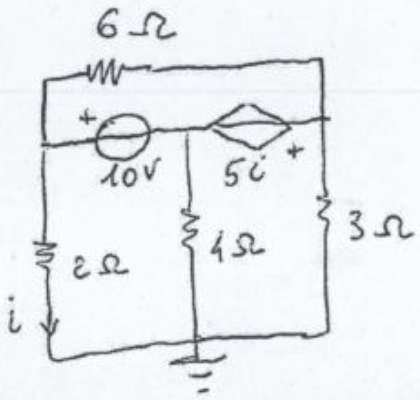
$i = \frac{23}{48} A$



Esercizio 3.15

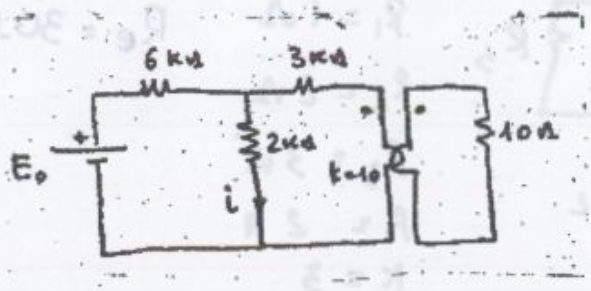
Calcolare i con il metodo ai nodi

$i = 1,521 A$



Esercizio 4.4

Calcolare Eo tale che i=10mA. Calcolare la potenza assorbita dal carico di 10Ω

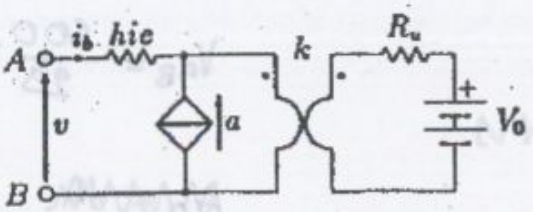


$E_o = 40V$

$P = 1/40\ W$

Esercizio 4.5

Calcolare equivalente Thevenin sapendo che il generatore pilotato ha relazione costitutiva a=h_{fe} i_b

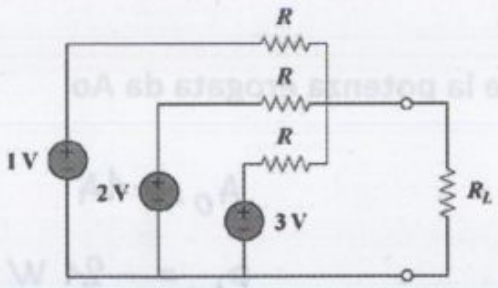


$N_0 = K\,V_0$

$R_e = k^2 R_u (1 + h_{fe}) + h_{ie}$

Esercisio 4.6

Calcolare R tale da avere massimo trasferimento di potenza su R_L pari a 3mW



$R = 1k\Omega$

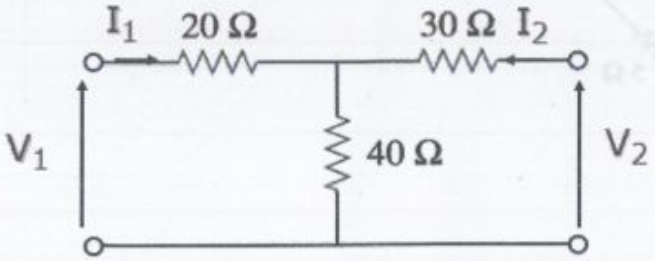
4.9

Dato un circuito alimentatore con potenza disponibile di 20W su carico adattato pari a 5Ω. Calcolare la potenza dissipata su un resistore da 15Ω di tale alimentatore.

$P = 15W$

Esercizio 4.10

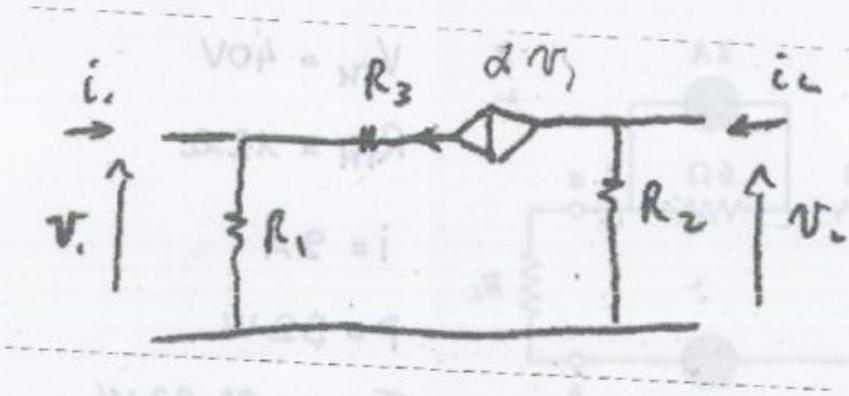
Calcolare la matrice delle resistenze del doppio bipolo



$$\begin{bmatrix} 60 & 40 \\ 40 & 70 \end{bmatrix} \Omega$$

Esercizio 4.11

Calcolare la matrice delle resistenze del doppio bipolo

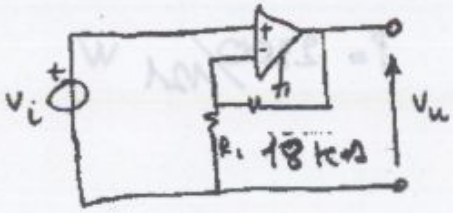


$$\begin{bmatrix} 60 & 40 \\ 40 & 70 \end{bmatrix} \Omega$$

$$\begin{bmatrix} \frac{R_1}{1-\alpha R_1} & 0 \\ \frac{-\alpha R_1 R_2}{1-\alpha R_1} & R_2 \end{bmatrix} \Omega$$

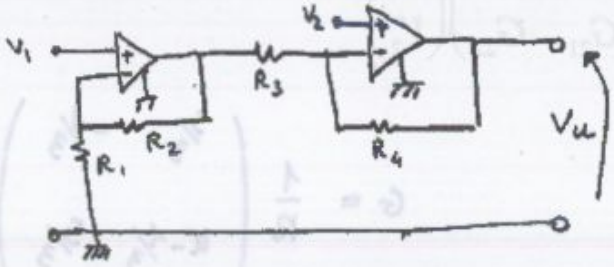
Esercizio 4.12

Calcolare la potenza entrante nel doppio bipolo (assorbita)



Esercizio 4.16

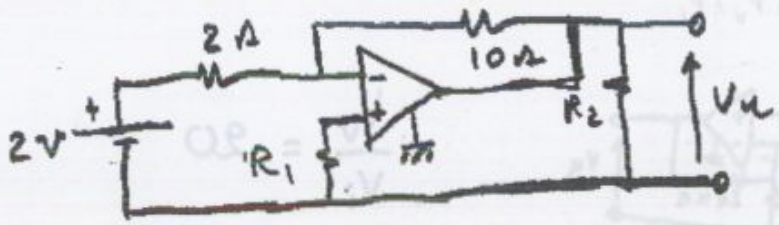
Calcolare Vu



$$V_U = \left[\left(1+\frac{R_2}{R_1}\right)V_1 - V_2\right] \cdot \left(-\frac{R_4}{R_3}\right) + V_2$$

Esercizio 4.17

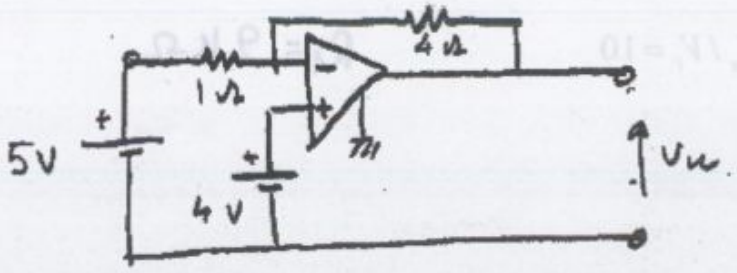
Calcolare Vu



$V_U = -10V$

Esercizio 4.18

Calcolare Vu



$V_U = 0V$

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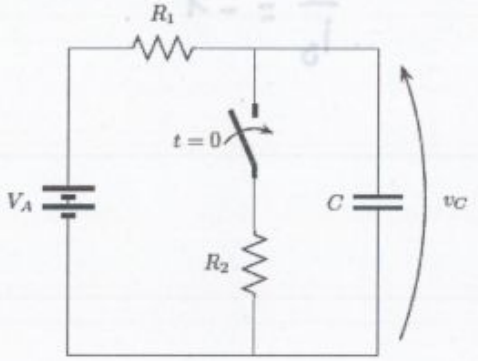
Esercizio 4.22

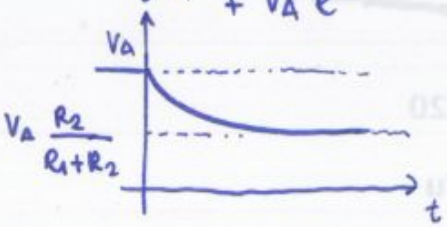
Calcolare e disegnare $v_c(t)$ $\forall t$



$$\tau = (R_1 // R_2)\,C$$

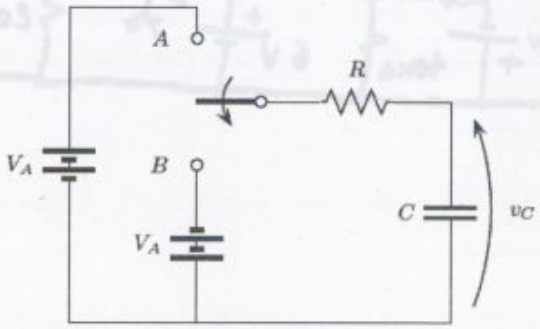
$$v_c(t) = -\frac{V_A R_2}{R_1 + R_2}\cdot\left(e^{-t/\tau} - 1\right) +$$

$$v_c(t) + V_A\, e^{-t/\tau}$$



Esercizio 4.23

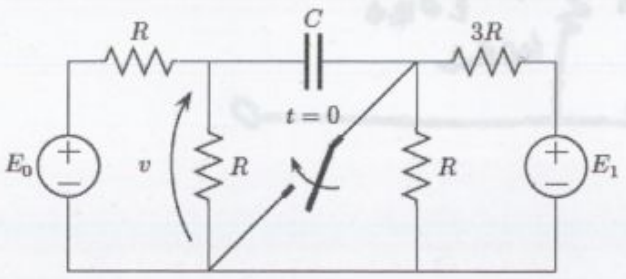
L'interruttore del circuito in figura è rimasto nella posizione A per un "lungo periodo" e viene spostato in B all'istante $t = 0$. Determinare l'espressione di $v_C(t)$ per $t \geq 0$. Ripetere l'esercizio nel caso in cui la posizione iniziale sia B e all'istante $t = 0$ si abbia la commutazione in A.



Esercizio 4.24

Calcolare e disegnare v(t) $\forall t$

$E_1 = 12\,V$



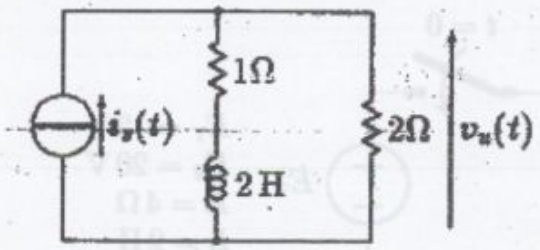
$E_0 = 12\,V$
$R = 4\,k\Omega$
$C = 1\,\mu F$

$v(t) = 6V \quad t<0$

$v(t) = -3e^{-t/\tau} + 6 \quad t>0$

Esercizio 4.28

Calcolare e disegnare $v_U(t)$ $\forall t$ data $i_S(t)=u(t)$ gradino unitario

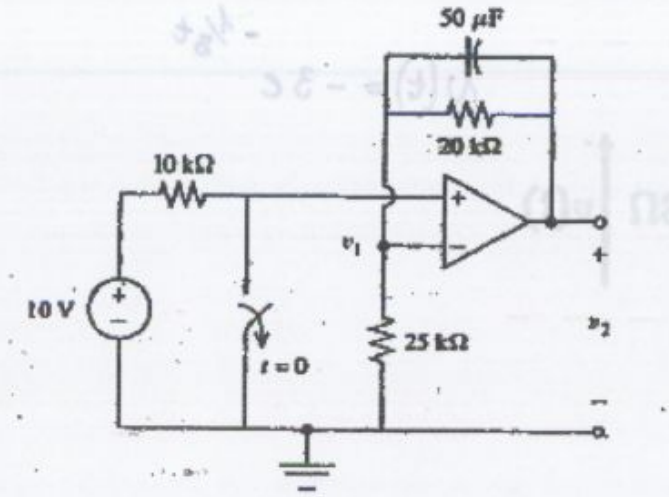


$$v_u(t) = \frac{2}{3}\left(1 - e^{-\frac{3}{2}t}\right)$$

$$= \frac{4}{3} e^{-\frac{2}{3}t} + \frac{2}{3}$$

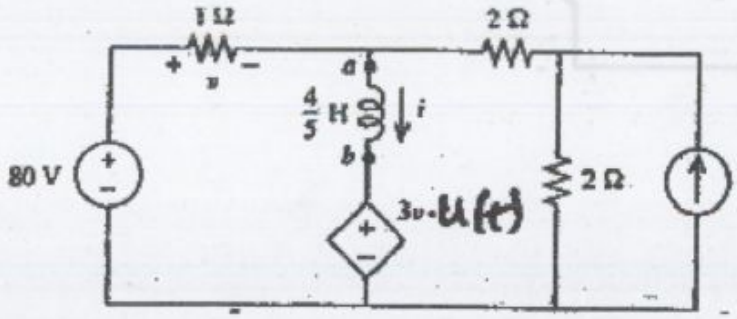
Esercizio 4.29

Calcolare e disegnare $v_2(t)$ $\forall t$



Esercizio 4.30

Calcolare e disegnare $i(t)$ $\forall t$



$t>0$

$$i(t) = 10 + 75\, e^{-4t} \text{ A}$$

$t<0$

$i(t) = 85$ A

Una calcolatrice che calcoli i numeri complessi è CALDAMENTE consigliata SHARP

Esercizio 5.1

Calcolare i seguenti numeri complessi in forma cartesiana

a) $\frac{2-3j}{4-j}$ b) $\left|\frac{3-2j}{1+2j}\right|$ c) $\frac{5+5j}{3-4j}+\frac{20}{4+3j}$ d) $(1+j)^2$-j e) $1+e^{2j\frac{\pi}{3}}+e^{-2j\frac{\pi}{3}}$

f) $\frac{j^4+j^9+j^{16}}{2-j^5+j^{10}-j^{15}}$ g) $\left|\frac{1+j}{1-j}\right|$ h) $e^{j\frac{\pi}{2}}$ m) $e^{j\pi}$ n) $e^{-j\frac{\pi}{4}}$.

Esercizio 5.2

Calcolare forma esponenziale

a) 2-2j b) $-1+j\sqrt{3}$ c) $2\sqrt{2}+j2\sqrt{2}$ d) –j e) –4

f) $-2\sqrt{3}-j2$ g) $\sqrt{2}$ h) $\frac{\sqrt{3}}{2}-j\frac{3}{2}$.

Esercizio 5.3

Calcolare modulo e argomento

a) 1-j b) –j c) –3 d) –1-j e) $-\frac{\sqrt{3}}{2}+\frac{j}{2}$.

Esercizio 5.4

Determinare i fasori delle seguenti grandezze

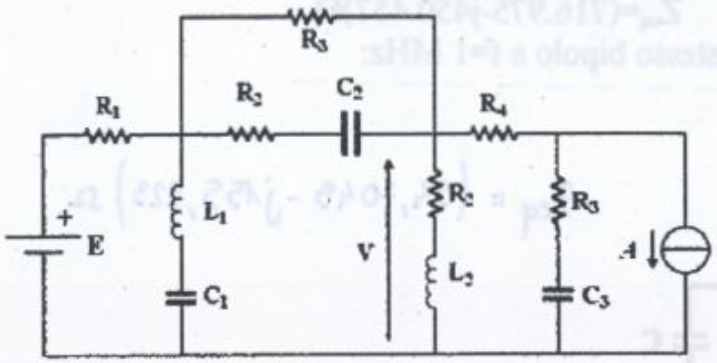
$f_1(t)=-3\sin(\omega t+\frac{\pi}{6})$ $f_2(t)=-\sin(-\omega t+\frac{2\pi}{15})$

$f_3(t)=\sin^2(\omega t)$ $f_4(t)=\frac{d^3}{dt^3}\sin(\omega t+\frac{\pi}{6})$

Esercizio 5.9

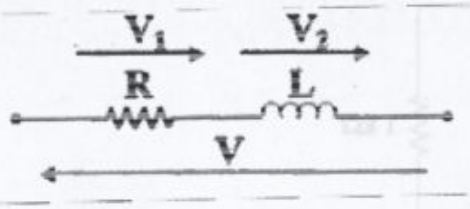
Calcolare V

$$V = \frac{\frac{E}{R_1+R_3} - A}{\frac{1}{R_1+R_3} + \frac{1}{R_2}}$$



Esercizio 5.10

Noti $|V_1|$= 1 V e $|V_2|$= 1 V, determinare il valore efficace di V. (b) Se i valori efficaci di V_1 e V_2 sono pari a $V_{c1}=V_{c2}$= 1 V, quanto vale il valore efficace di V?



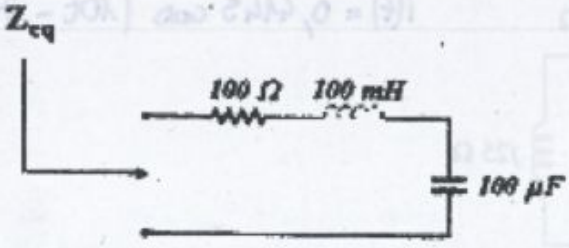
$V_e = 1V$

$V_e = \sqrt{2}\ V$

Esercizio 5.11

Calcolare l'impedenza equivalente alle pulsazioni

$\omega_1=10^3$ rad/s, $\omega_2=10^2$ rad/s e $\omega_3=100\sqrt{10}$ rad/s:



$\omega_1 = z_{eq} = (100 + j\,90)\,\Omega$

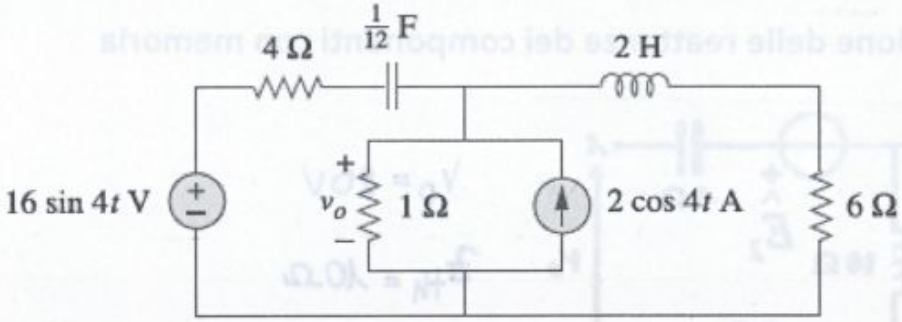
$\omega_2 = z_{eq} = (100 - j\,90)\,\Omega$

$\omega_3 = z_{eq} = (100)\,\Omega$

Esercizio 5.15

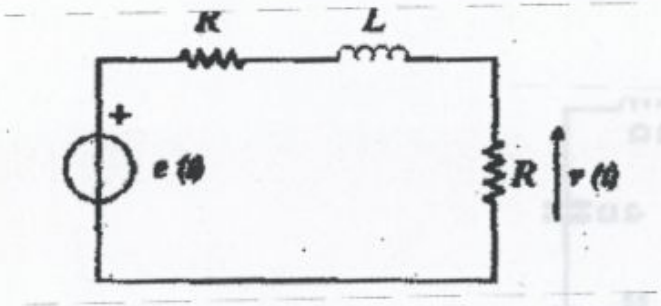
Calcolare $v_o(t)$

$v_o(t) = 3{,}835 \cos(4t - 35{,}02^\circ)\ V$



Esercizio 5.16

Calcolare v(t) sapendo che $e(t)=2\cos^2(2t)$ V, R=1Ω, L=0.5H, C=0.5F

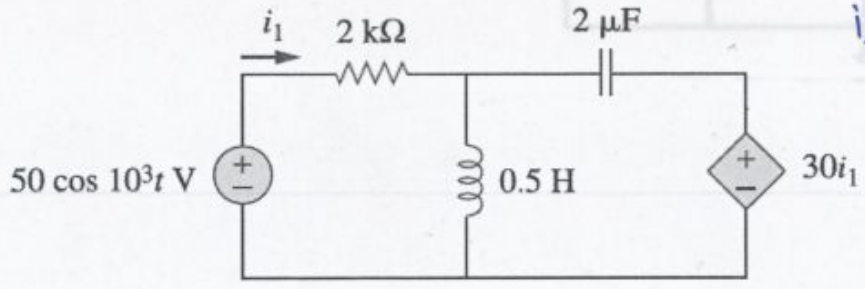


$v(t) = \frac{1}{2} + \frac{1}{2}\cos(4t - 45^\circ)\ V$

Esercizio 5.17

Calcolare $i_1(t)$

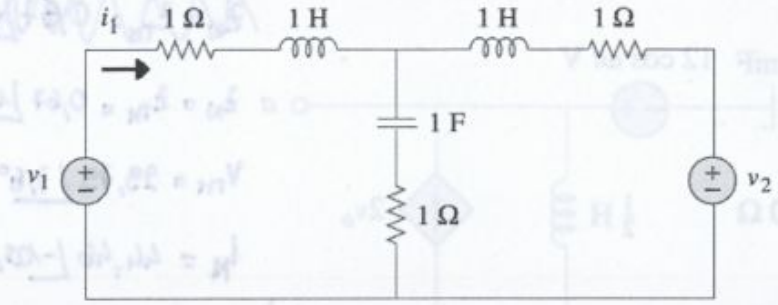
$i_1(t) = 0\ A$



Esercizio 5.20

$i_1(t) = 2{,}741 \cos(4t - 41{,}07°)\ A$

Calcolare $i_1(t)$



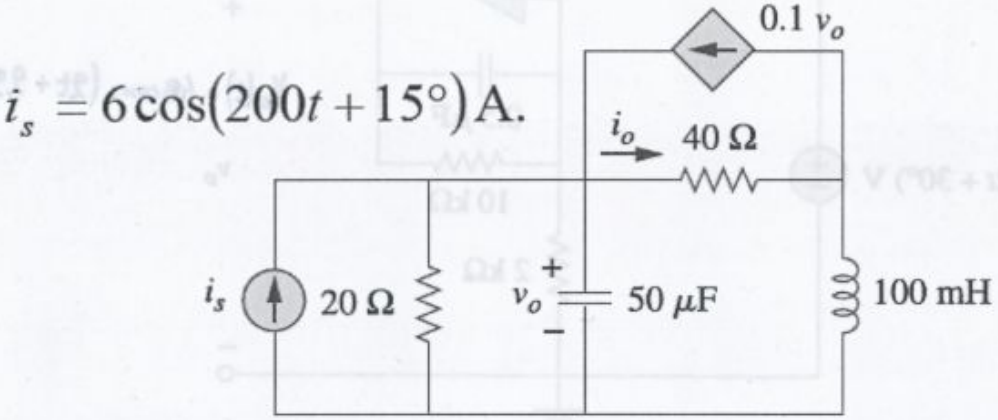
$v_1 = 10\cos 4t\ \mathrm{V}$

$v_2 = 20\cos(4t - 30°)\ \mathrm{V}$

Esercizio 5.21

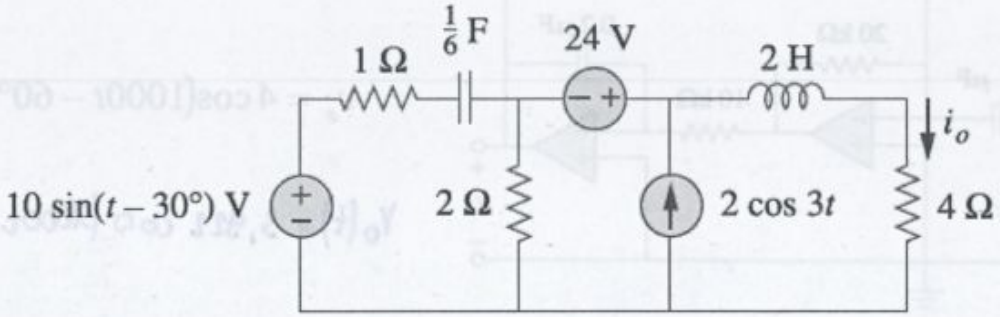
$i_1(t) = 7{,}276 \cos(200t - 52{,}17°)\ A$

Calcolare tramite il metodo ai nodi $i_o(t)$



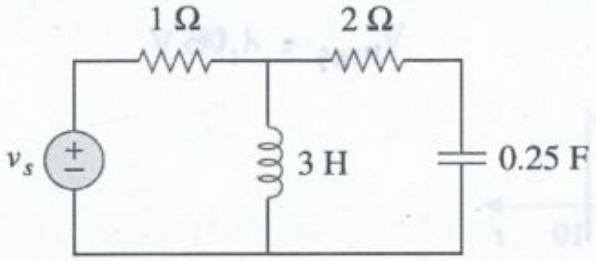
Esercizio 5.22 → $i_o(t) = -4 + 0{,}504 \sin(t + 19{,}1°) + 0{,}3352 \cos(3t - 76{,}43°)$

Calcolare $i_o(t)$



Esercizio 5.26

Calcolare la potenza media assorbita dai componenti passivi



$$v_s = 8\cos(2t - 40^\circ)\ \text{V}$$

$P_{1\Omega} = 1{,}4159\ \text{W}$

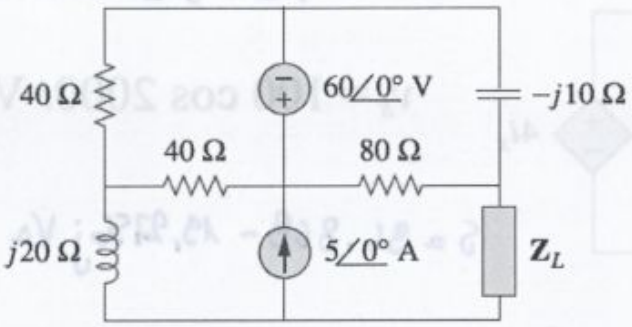
$P_{3H} = P_{0{,}25F} = 0\ \text{W}$

$P_{2\Omega} = 5{,}097\ \text{W}$

Esercizio 5.27

Determinare Z_L tale da avere massimo trasferimento di potenza.

E' ohmica, capacitiva, induttiva o ohmica-capacitiva o ohmica induttiva?

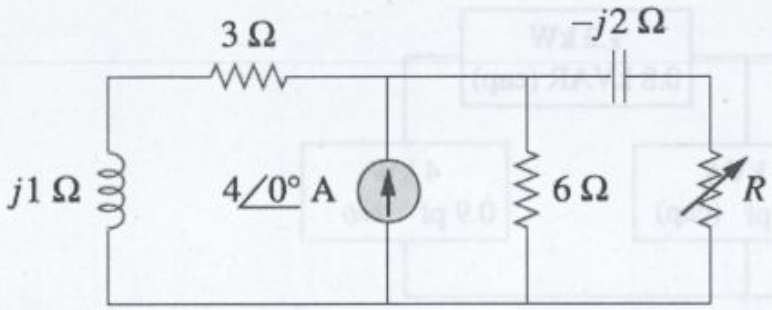


$Z_L = 21{,}23 - j10{,}15\ \Omega$

OHMICA CAPACITIVA

Esercizio 5.28

Calcolare R tale da avere massimo trasferimento di potenza, calcolare quindi la massima potenza assorbita da R.



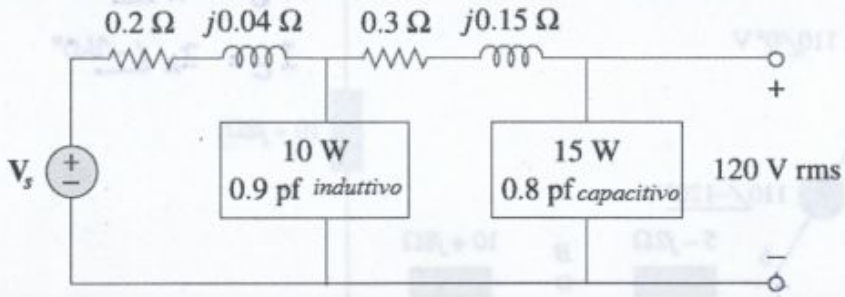
$R_L = 2{,}576\ \Omega$

$P_{MAX} = 3{,}798\ \text{W}$

Esercizio 5.32

Calcolare il fasore Vs

120,06 ∠0,03°



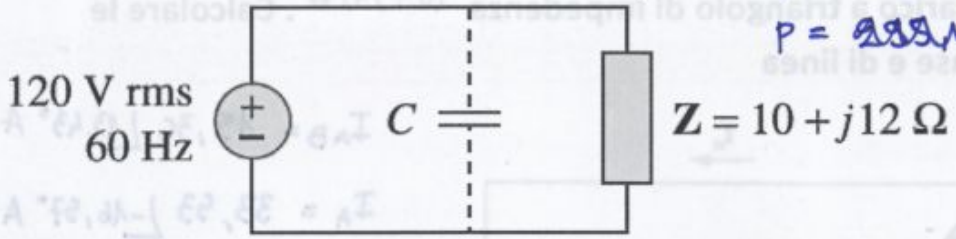
Esercizio 5.33

Quanto vale il pf del carico? Quanto vale la potenza attiva assorbita dal carico? Quale e' il valore della capacita' C da inserire in modo tale da avere pf=1?

pf = cos θ = 0,6402

P = 590,164W

C = 130,4 μF



Esercizio 5.34

Due carichi sono collegati in parallelo e assorbono una potenza pari a 2.4kW con pf=0.8 induttivo. Sono collegati ad una linea a 120Veff a 60Hz. Un carico assorbe 1.5kW con pf=0.707 induttivo. Determinare: 1) il pf del 2° carico, b) l'elemento da inserire in parallelo per correggere il pf totale a 0.9 induttivo.

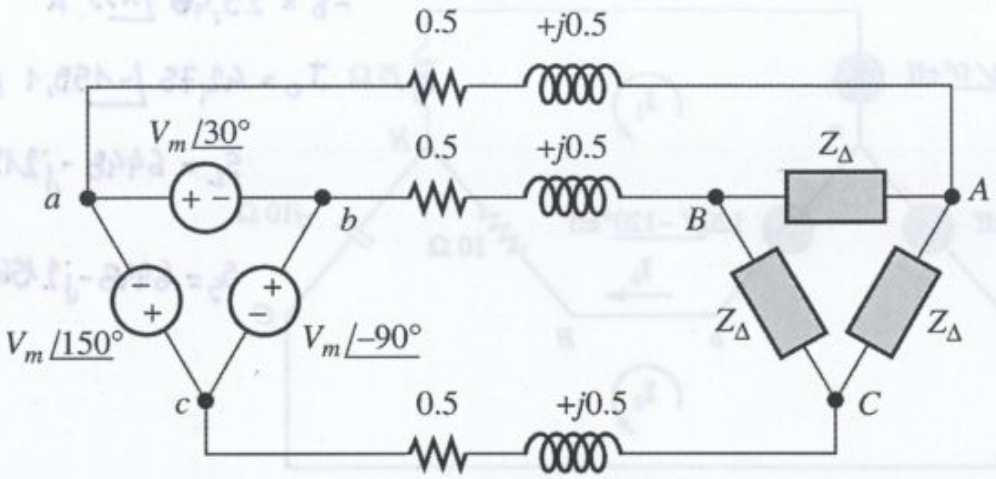
pf = 0,9487

C = 117,5 μF

Esercizio 5.37

Dati Vm eff=440V, $Z_\Delta = 10 - 2j\,\Omega$, calcolare $\hat{I}_{aA}, \hat{V}_{AB}, \hat{I}_{AB}$

Calcolare la potenza complessiva fornita al carico a triangolo e la potenza persa nella linea



Esercizio 5.38

Con riferimento all'esercizio 5.35, calcolare la potenza attiva totale , la potenza reattiva totale e la potenza complessa totale erogata dal generatore e assorbita dal carico

$S_S = (2087 + j\,834{,}6)$ VA

$S_L = (1392 + j\,1713)$ VA

Esercizio 5.39

Un motore trifase puo' essere modellato come un carico trifase a stella. Se il motore assorbe 5.6kW ad una tensione di linea pari a 220V e corrente di linea pari a 18.2 A. Calcolare il fattore di potenza.

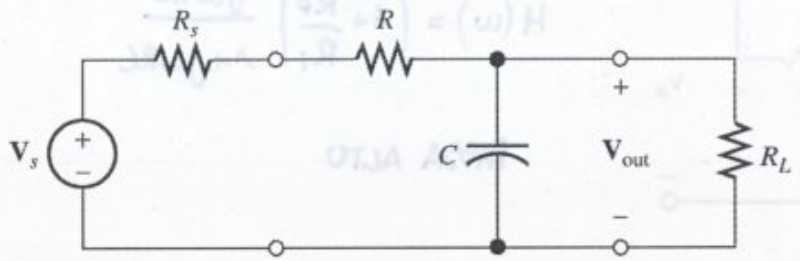
pf = 0,8075

Esercizio 5.42

Calcolare la funzione di trasferimento $H(f)=\frac{V_{out}}{V_s}$

Dire quale tipo di proprieta' filtranti ha il sistema

$$H(f)=\frac{R_L}{R_L+R+R_S}\cdot\frac{1}{1+j\left(f/f_B\right)}$$



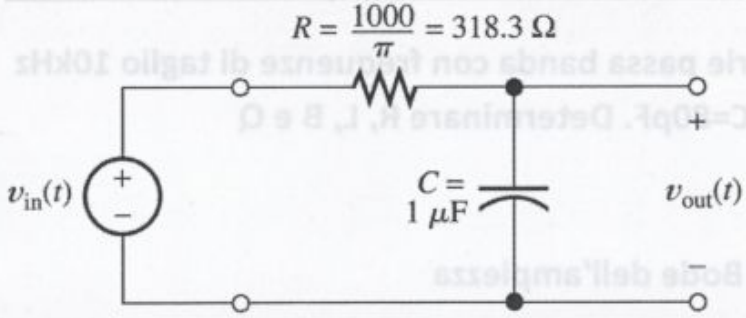
$$f_B=\frac{1}{2\pi R_{eq}C}$$

$$R_{eq}=R_L\,/\!/\,(R+R_S)$$

Esercizio 5.43

Calcolare il segnale di uscita del seguente filtro per ingresso

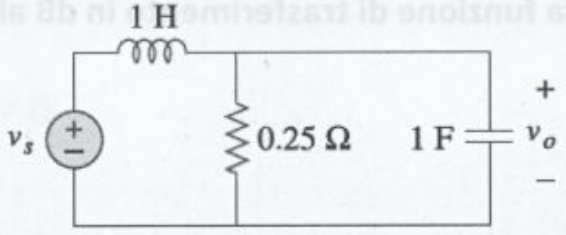
$v_{in}(t)=5\cos(500\pi t)+5\cos(1000pt)+5\cos(2000\pi t)$ V



Esercizio 5.44

Calcolare la funzione di trasferimento $\mathbf{V}_o/\mathbf{V}_s$ **e mostrare che il filtro e' un bassa basso**

$$H(\omega)=\frac{R}{R+j\omega L-\omega^2RLC}$$



$$H(0)=1$$

$$H(\infty)=0$$

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Esercizio 5.50: Disegnare il diagramma di Bode dell'ampiezza(attenzione quotare il diagramma).

$$\mathbf{H}(\omega) = \frac{50(j\omega+1)}{j\omega(-\omega^2+10j\omega+25)}$$

Esercizio 5.51

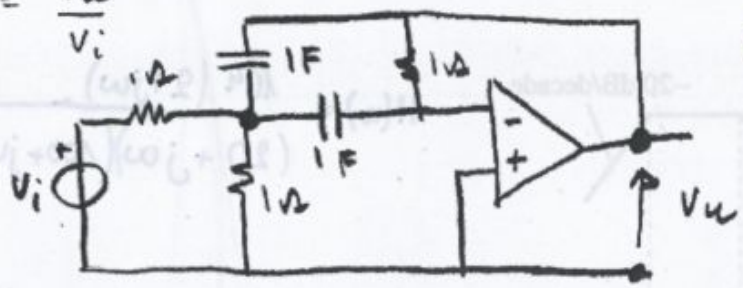
Disegnare il diagramma di Bode dell'ampiezza

$$H(s) = \frac{s(s+20)}{(s+1)(s^2+60s+400)}, \qquad s=j\omega$$

Esercizio 5.52

Calcolare la funzione di trasferimento nel dominio dei fasori (s=jω)

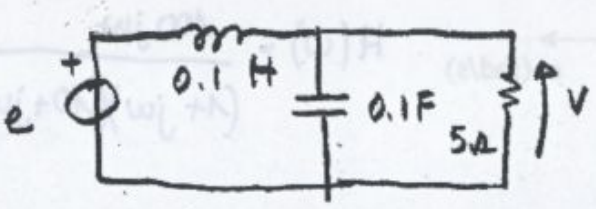
$H(s) = \frac{V_u}{V_i}$



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

Esercizio 5.53

Calcolare la funzione di trasferimento H(ω)=Vo(ω)/E(ω ; disegnarne il diagramma di Bode dell'ampiezza; calcolare l'uscita $v_o(t)$ per ingresso e(t)=10+10cos(100t-1.15733°)V



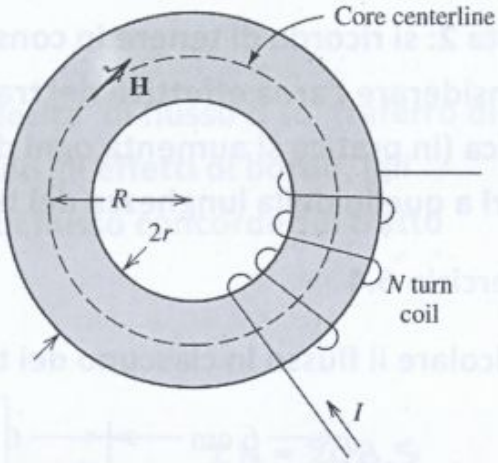
$$H(s) = \frac{100}{s^2+2s+100}$$

$$V_o(t) = 10 - 0.1\cos(100t)\,V$$

N i(t) μ

Esercizio 6.1

Calcolo del flusso totale e del flusso concatenato di una bobina avvolta in un nucleo toroidale supponendo di avere N spire avvolte, corrente I(t), permeabilita' μ, e che R>>r



Usare 2 strategie per il calcolo:
1)calcolo tramite la legge di Ampere,
2) calcolo usando il circuito magnetico e il concetto di riluttanza

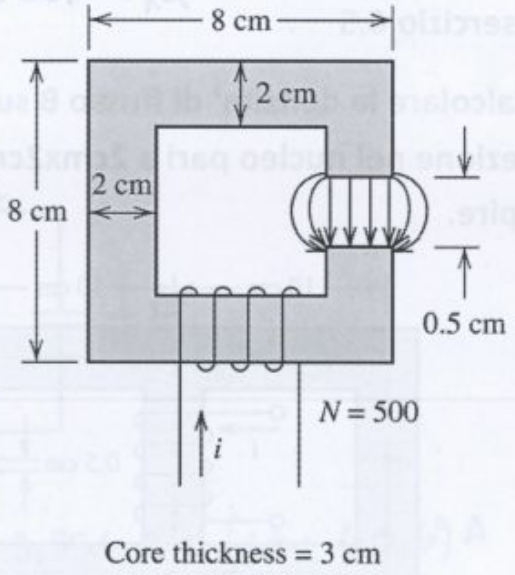
Esercizio 6.2

Calcolo del flusso totale e del flusso concatenato di una bobina avvolta in un nucleo toroidale supponendo di avere N spire avvolte, corrente I(t), permeabilita' m, e che R>>r. Calcolare la forza elettromotrice indotta ai capi della bobina. Parametri del problema: μ_r=5000, R=10cm, r=2cm, N=100, I(t)=2sin(200πt) A.

Esercizio 6.3

Determinare il valore della corrente I tale da ottenere nel circuito magnetico in figura un campo B sul traferro (gap) pari a 0.25T. [spessore nel nucleo 3cm, μ_r=6000]

Nota 1: si ricorda di tenere in conto nella valutazione delle riluttanze dei percorsi centrali (al centro nel materiale magnetico)



i = 2,012A

$\eta_{reg} = 4,35\%$

μ η = 91,76 %

$I = 184,8$

Esercizio 6.14

Un motore DC da 50hp e' alimentato a 220V e presenta perdite di 3350W a pieno carico. La velocita' a pieno carico e' 1150rpm. In assenza di carico e' 1200rpm. Calcolare la corrente di alimentazione, il rendimento a pieno carico e la regolazione di velocita'

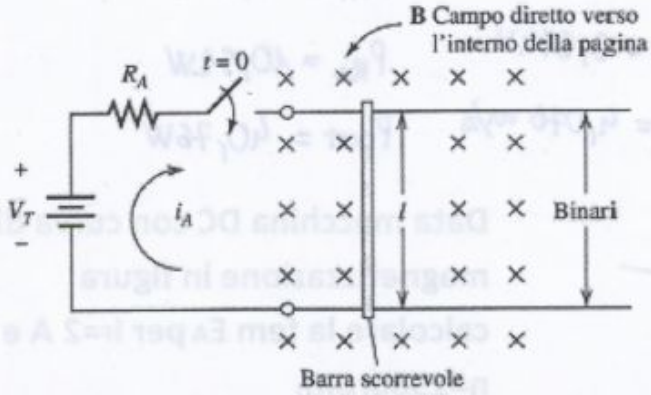
Esercizio 6.15

Data la macchina lineare

A Vel raddoppia

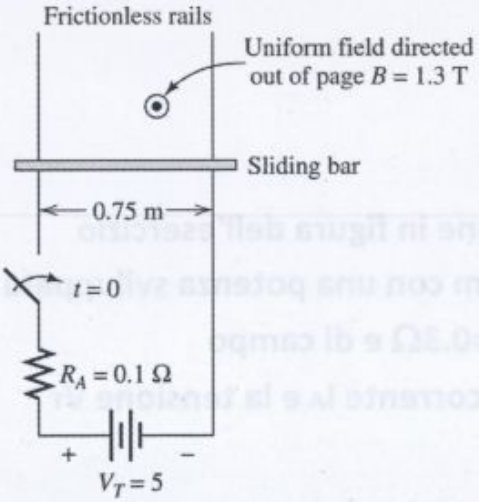
B è la stessa

C dimezza



In assenza di carico, cosa accade alla velocita' stazionaria se a) la tensione V_T raddoppia, b) la resistenza R_A raddoppia, c) la intensita' del flusso magnetico B raddoppia?

Esercizio 6.16



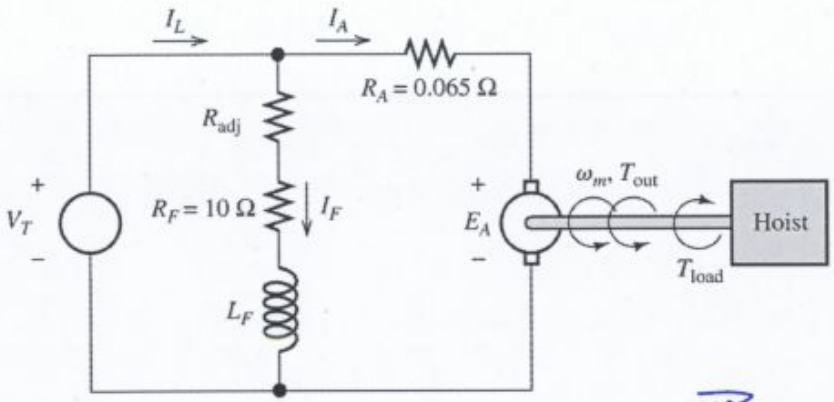
Data la macchina lineare in figura,. Quando l'interruttore si chiude in quale direzione la barra si sposta? Calcolare l'ampezza della forza iniziale. Determinare il valore della velocita' finale trascurando l'attrito.

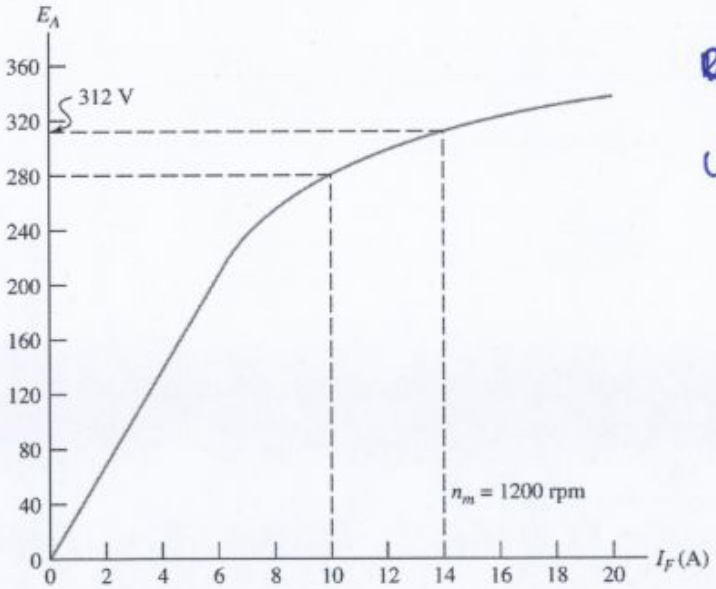
$f_{starting} = 48,75N$

$\mu = 5,13$ m/s

Esercizio 6.20

Un motore DC collegato in parallelo di 50hp ha curva di magnetizzazione come in figura. La tensione di alimentazione e' di V_T =300V, R_A=0.065Ω e di campo R_F= 10Ω, I_F=10 A. Calcolare R_{adj}. Alla velocita' di 1200rpm la perdita rotazionale e' 1450W, Dopo aver applicato un carico pari alla coppia di T_{out}=250Nm si determini la velocita' del rotore.





ω_m

$R_{adj} = 20\ \Omega$

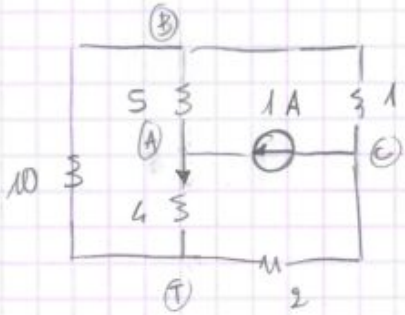
$\omega_m = 131{,}2$ rad/sec

Esercizio 6.21

Ripetere esempio su motore collegato in serie nelle slide

3.1

$V_A = 2,041\ V$



(A) $\frac{V_A}{4} - 1A + \frac{V_A - V_B}{5} = 0$

(B) $\frac{V_B}{10} + \frac{V_B - V_A}{5} + \frac{V_B - V_C}{1} = 0$

(C) $\frac{V_C}{2} + 1A + \frac{V_C - V_B}{1} = 0$

$$\begin{cases} \frac{V_A}{4} - 1 + \frac{V_A}{9} - \frac{V_B}{5} = 0 \\ \frac{V_B}{10} + \frac{V_B}{5} - \frac{V_A}{6} + V_B - V_C = 0 \\ \frac{V_C}{2} - 1 + V_C - V_B = 0 \end{cases}$$

$$\begin{cases} \frac{9}{20} V_A - \frac{V_B}{5} - 1 = 0 \\ \frac{13}{10} V_B - \frac{V_A}{5} - V_C = 0 \\ -V_B + \frac{3}{2} V_C - 1 = 0 \end{cases}$$

$V_B = \frac{9}{4} V_A - 5$

$\frac{117}{40} V_A - \frac{13}{2} - \frac{1}{5} V_A - V_C = 0$

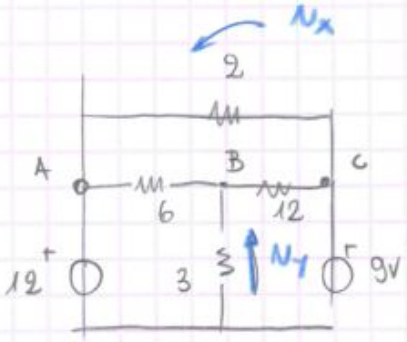
$V_C = \frac{2}{3} \frac{9}{4} V_A - \frac{2}{3} \cdot 6$

$$\begin{cases} V_B = \frac{9}{4} V_A - 5 \\ \frac{109}{40} V_A - \frac{13}{2} = V_C \\ V_C = \frac{3}{2} V_A - 4 \end{cases}$$

$\frac{109}{40} V_A - \frac{13}{2} = \frac{3}{2} V_A - 4$

$V_A = 2,0408\ V$

3, 2



$V_x = 8V$

$V_y = 4,71$

$V_A = 12V$

$V_C = 9V$

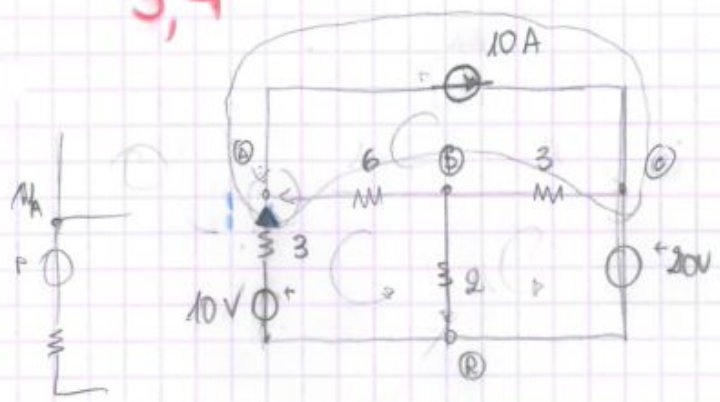
$V_A - V_C = 12 - 9 = 3V$

(B) $\frac{V_B}{3} + \frac{V_B - V_C}{12} + \frac{V_B - V_A}{6} = 0$

$\frac{V_B}{3} + \frac{V_B}{12} - \frac{9}{12} + \frac{V_B}{6} - 2 = 0$

$\frac{7}{12} V_B - \frac{11}{4} \rightarrow V_B = 4,71\ V = V_y$

3,4



$i = 7,255\ A$

$$i = \frac{10 - V_A}{3} \qquad -i$$

$V_C = 20V$

$$i =$$

$$\begin{cases} \text{(A)} \quad -i + \dfrac{V_A - V_B}{6} + 10A = 0 \quad -\dfrac{10}{3} + \dfrac{V_A}{3} + \dfrac{V_A}{6} - \dfrac{V_B}{6} + 10A = 0 \\ \text{(B)} \quad \dfrac{V_B}{2} + \dfrac{V_B - V_A}{6} + \dfrac{V_B - V_C}{3} = 0 \quad V_B\left(\dfrac{1}{2} + \dfrac{1}{6} + \dfrac{1}{3}\right) - \dfrac{1}{6}V_A - \dfrac{20}{3} = 0 \\ \text{(C)} \quad V_C = 20V \end{cases}$$

$$\frac{V_B}{3} - \frac{40}{3}$$

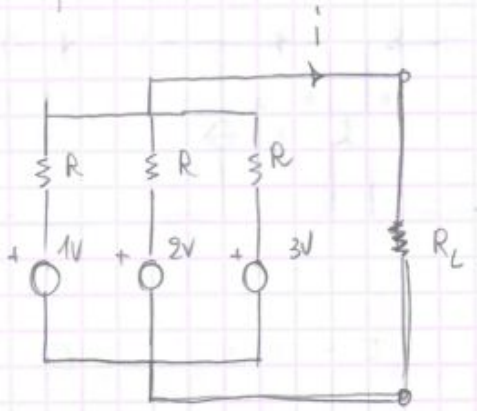
$$\begin{cases} +\dfrac{V_A}{2} - \dfrac{V_B}{6} = -\dfrac{20}{3} \\ V_B - \dfrac{1}{6}V_A - \dfrac{20}{3} = 0 \end{cases} \qquad \begin{cases} V_A = \left(\dfrac{V_B}{6} - \dfrac{20}{3}\right)2 \\ V_B - \dfrac{V_B}{18} + \dfrac{40}{18} - \dfrac{20}{3} = 0 \end{cases}$$

$$V_A = -11,79\ V$$

$$V_B\left(1 - \frac{1}{18}\right) = \frac{40}{9} \longrightarrow V_B = \frac{80}{17} = 4,70\ V$$

$$i = \frac{10 - (-11,79)}{3} = 7,26\ A$$

4,6 $R = 1k$

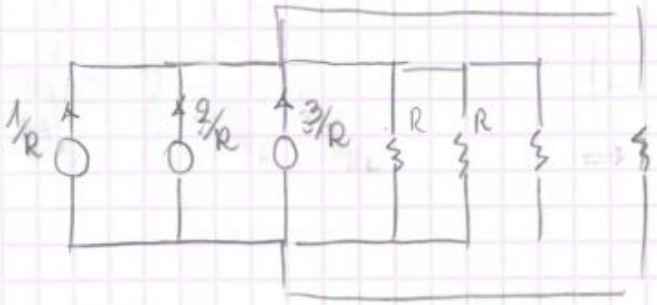


$P_L = 3mW$

$P = Vi$

$P = Ri^2$

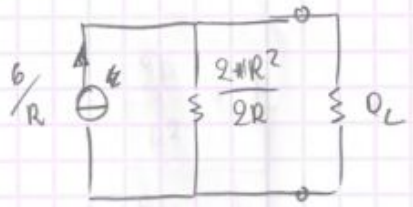
$V = Ri$



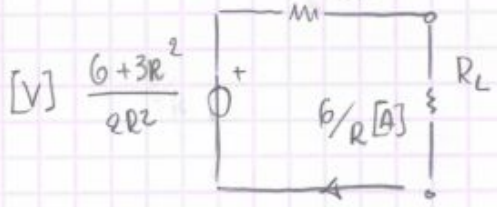
$$\frac{R+R}{R \cdot R} = \frac{2R}{R^2} + R$$

$$\frac{2}{R} \quad R$$

$$\frac{2+R^2}{2R}$$



$$\frac{2+R^2}{2R}\ [\Omega]$$



$$\frac{6^3}{R} \cdot \frac{2+R^2}{2R}$$

$$\frac{6+3R^2}{2R^2}$$

$$R_L = \frac{2+R^2}{2R}$$

$$2R\,R_L = 2+R^2$$

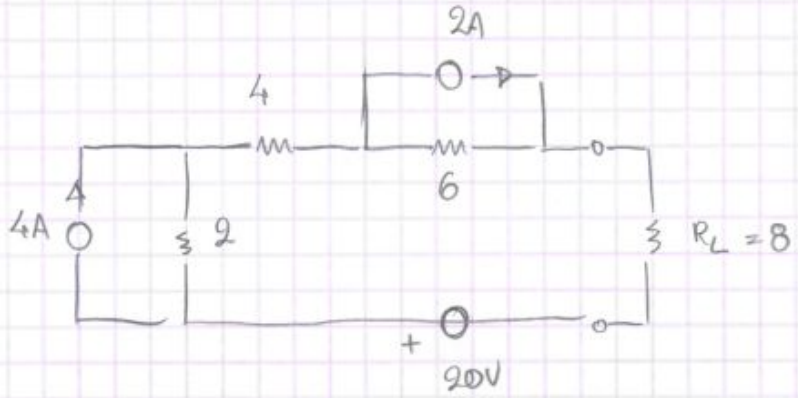
$$R^2 - 2R_L R + 2 = 0$$

4,8

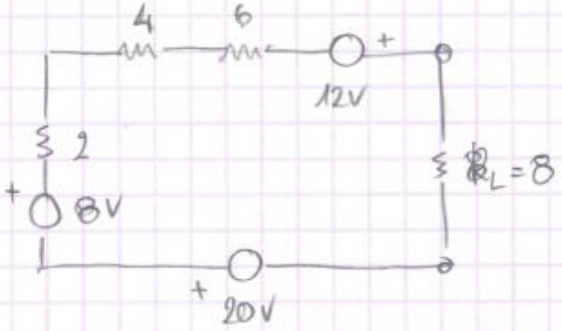
$V_{TH} = 40V$ $\quad i = 2$

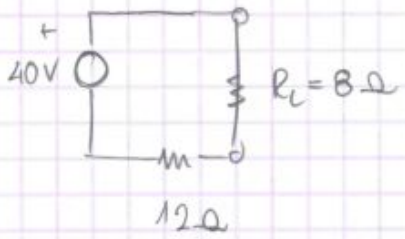
$R_{TH} = 12\Omega$ $\quad p = 32W$

$P_{MAX} = 33,3\ W$



$V = R\,i$





$$i = \frac{40}{(12+8)} = 2\,A$$

MAX TRASF $\quad R_L = R_{eq} = 12\Omega$

$$i' = \frac{40\,V}{(12)\cdot 2} = 1,67\,A \quad \rightarrow \quad V_{R_L} = i' \cdot R_L$$

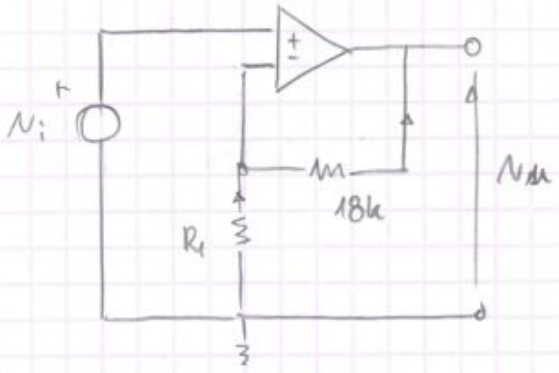
$$= 1,67 \cdot 12$$

$$= 20\ V$$

$$P_{R_L\ MAX} = V_{R_L} \cdot i' = 33,4\ W$$

4.15 2k

$A = 10 \rightarrow R_1 = ?$



$$A = 10 = \frac{v_M}{v_i}$$

$$v_i = v_+ = v_- = v_{R_1}$$

$$v_{R_1} = v_M \cdot \frac{R_1}{R_1 + 18} \Rightarrow \frac{v_i}{v_M} = \cancel{v_M} \cdot \frac{R_1}{R_1 + 18}$$

$$\frac{v_M}{v_i} = \frac{R_1 + 18k}{R_1} = 10$$

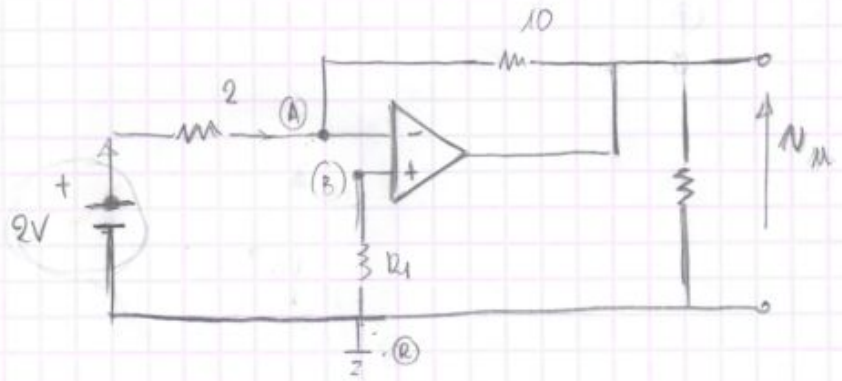
$$\Rightarrow 10R_1 = R_1 + 18k$$

$$9R_1 = 18k$$

$$R_1 = 2k$$

4.17

$v_u = -10$

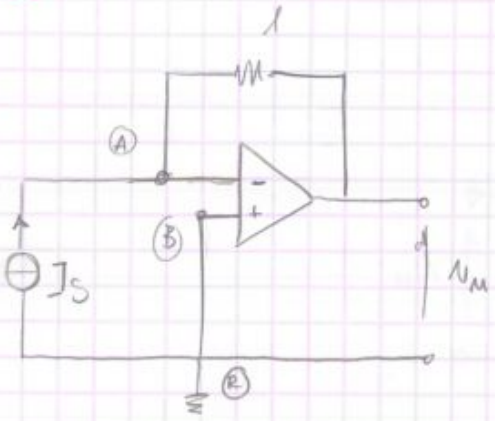


A) $\frac{v_A - 2}{2} + \frac{v_A - v_u}{10} = 0 \rightarrow v_u = -10\ V$

B) $\frac{v_B - v_R}{R_1} = 0 \Rightarrow v_B = v_+ = v_- = v_A = 0$

4,19

$$\frac{V_M}{I_S} = -1$$

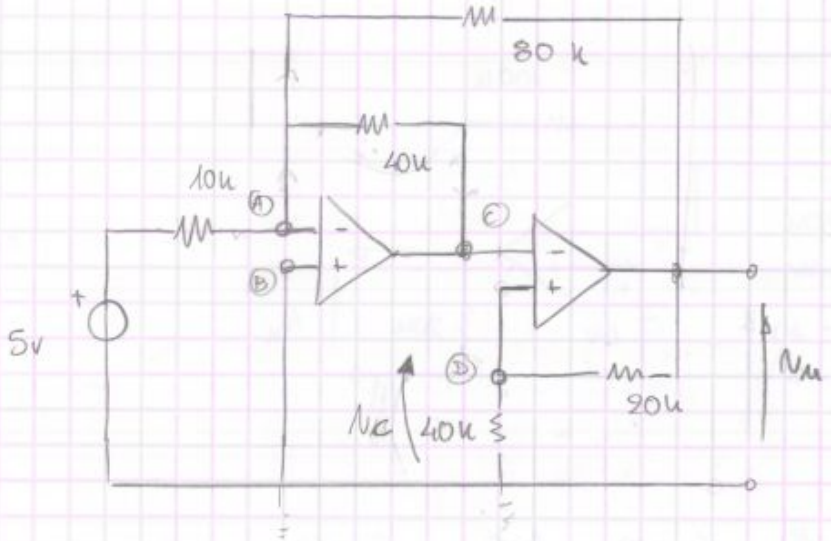


(B) $V_B = 0 = V_+ = V_- = V_A$

(A) $-J_S + \frac{V_A^{\,0} - V_M}{1}$ $\qquad \frac{V_M}{I_S} = -1$

4.21

$V_M = -11,43\ V$



(B) $V_B = V_A = 0$

(A) $\frac{V_A - 5}{10k} + \frac{V_A - V_M}{80k} + \frac{V_A - V_C}{40k}$

(D) $\frac{V_C}{40} + \frac{V_C - V_M}{20} = 0$

$-\frac{1}{2} - \frac{V_C}{40} - \frac{1}{10} V_M = 0$

$\frac{-20 - V_C - 4V_M = 0}{40}$

$V_C = -20 - 4V_M$

$V_C + 2V_C - 2V_M = 0$

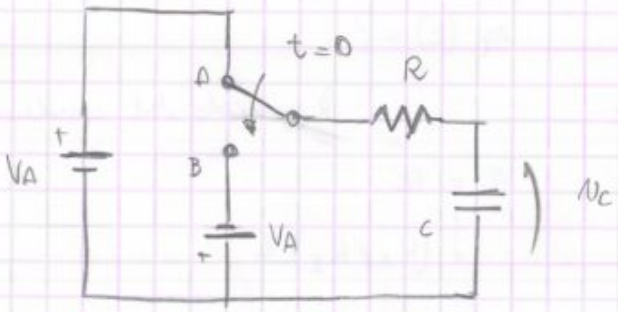
$-20 - 4V_M + 2(-20 - 4V_M) - 2V_M = 0$

$-20 - 4V_M - 40 - 8V_M - 2V_M = 0$

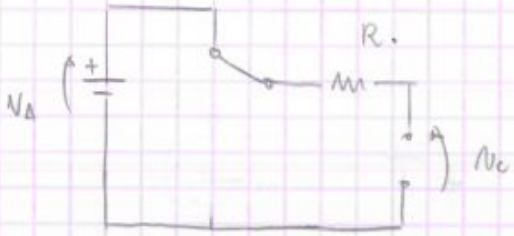
$-60 = 14 V_M$

$V_M = \frac{3}{42} V_C \qquad V_M = 1,5 V_C \longrightarrow \qquad V_C = -11,43$

4, 23

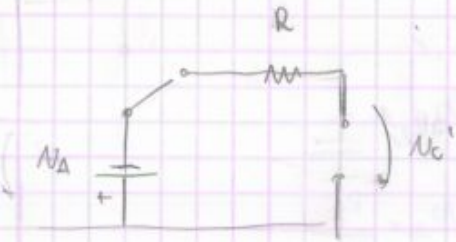


$t = 0^-$



$v_c^0 = V_A$

$t = \infty$

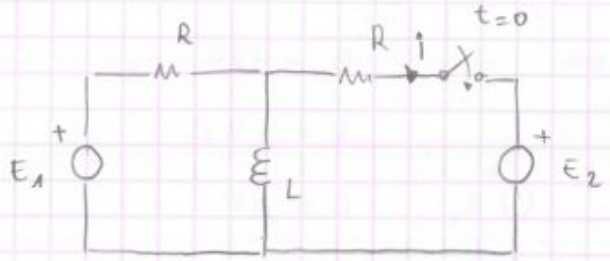


$v_c^\infty = -V_A$

$$v_c(t) = -V_A + \left[V_A - (-V_A)\right] e^{-t/\tau}$$

$$= -V_A + 2V_A e^{-t/\tau}$$

4,25



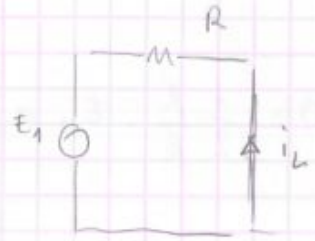
$E_1 = 12V$ $\quad i = ?$

$E_2 = 20V$

$R = 4\,\Omega$

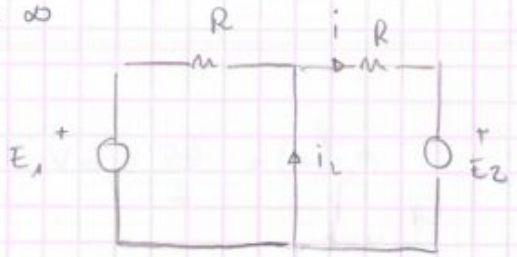
$L = 2H$

$t = 0^-$



$$i_L = \frac{E_1}{R} = 3\ A$$

$t = \infty$



$$i_L = 2\ A$$

$$\tau = \frac{1}{2 \cdot 2} = \frac{1}{4}$$

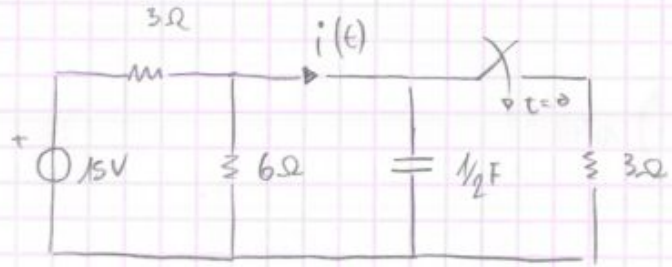
$$i_L(t) = \frac{1}{4} + \left[3 - \frac{1}{4}\right] e^{-t/0,25}$$

$$= 0,25 + 2,75\, e^{-t/0,25}$$

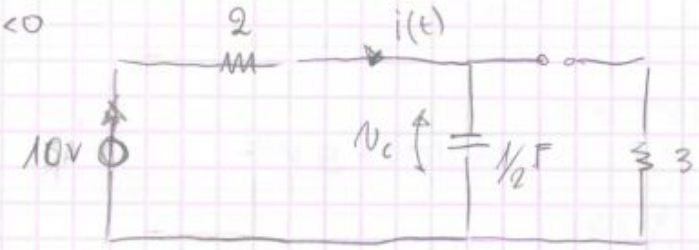
$$i(t) = \frac{E_2}{R} + \frac{0,25 + 2,75\, e^{-t/0,25}}{R}$$

$$= 5 + 0,0625 + 0,6875\, e^{-t/0,25}$$

4, 27

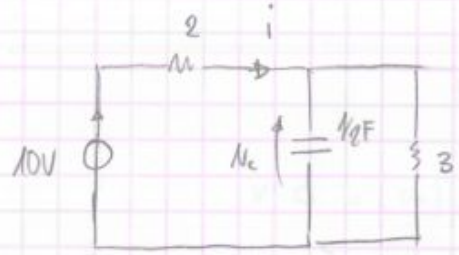


$t<0$



$v_c(0^-) = 10V$

$t = \infty$



$v_c(\infty) = 6V$

$\tau = \frac{6}{5} \cdot \frac{1}{2} = \frac{3}{5}$

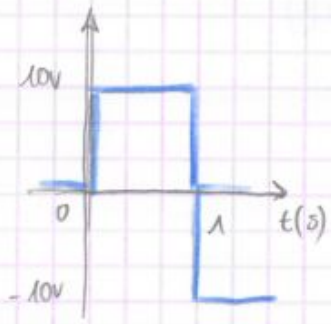
$v_c = 6\left(e^{-3t/5} - 1\right) + 10e^{-t/\tau}$

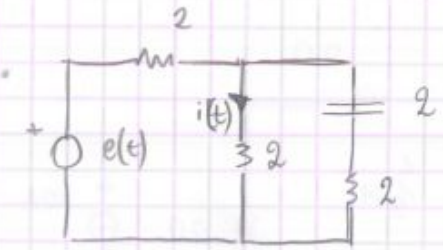
$10V - 6\left(e^{-t/\tau} - 1\right) - 10e^{-t/\tau} - 2i = 0$

$i = 5 - 3\left(1 - e^{-t/\tau}\right) - 3e^{-t/\tau}$

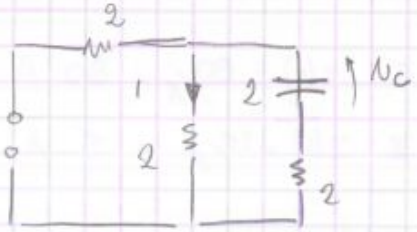
$= 2\left(1 - e^{-t/\tau}\right)$

4, 31



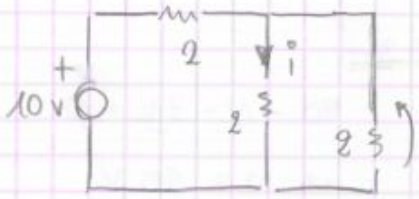


$t < 0$



$V_c(0^+) = 0$

$t > 0^+$



$V_c(0^+) = 3,3\ V$

$i = V/R = 1,67\ A$

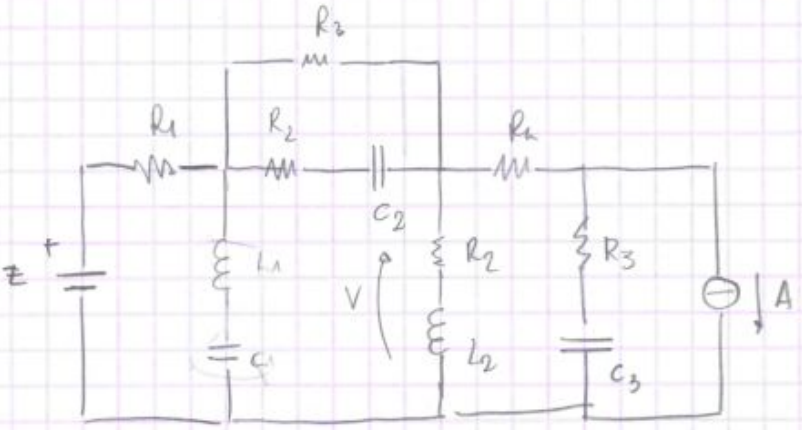
$\tau = 6$

$t = \infty$

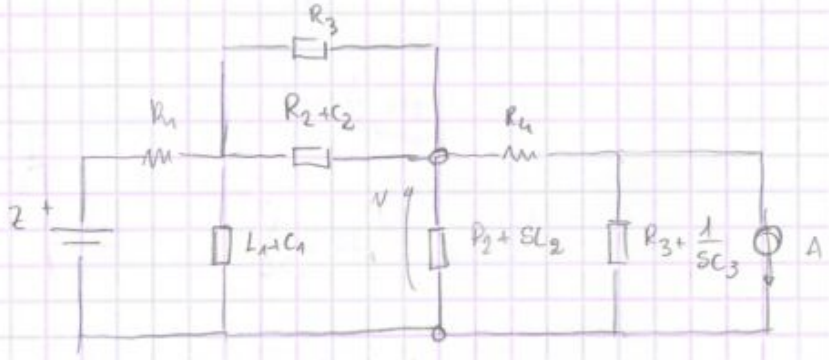
$$i(t) = 0 + [1,67 - 0]e^{-t/6}$$

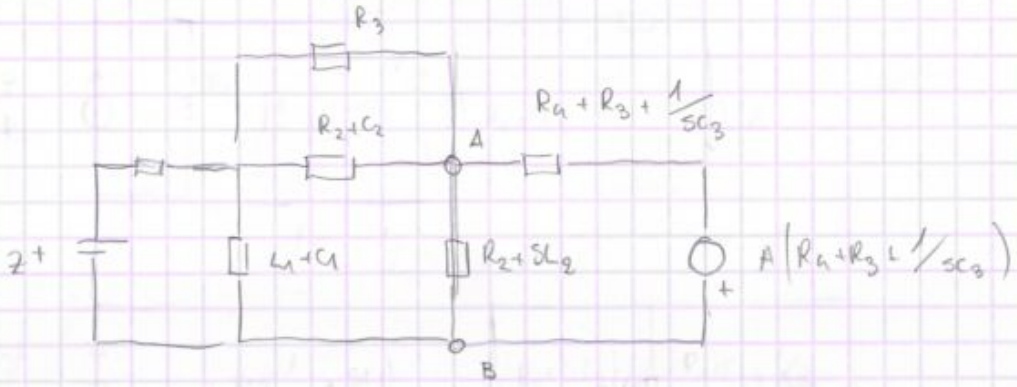
$$= 1,67\, e^{-t/6}$$

5.9



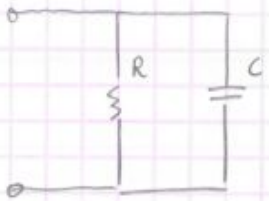
$V = R\,i$





$$N_{AB} = A\left(R_4 + R_3 + \frac{1}{sC_3}\right)^2$$

5, 12



$f = 100\ Hz$

$Z_{eq} = (716,975 - j\,450,487)\,\Omega$

$f = 1MHz \rightarrow Z_{eq} = ?$

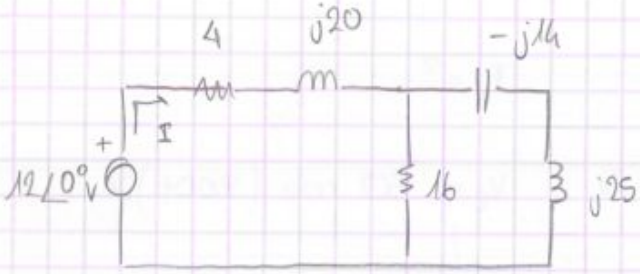
$$Z_{eq} = R /\!/ C$$

$$= R \cdot \frac{1}{j\omega C} \cdot \frac{1}{R + \frac{1}{j\omega C}}$$

$$= R \cdot \frac{1}{j\omega C} \cdot \frac{j\omega C}{j\omega C R + 1}$$

$$= \frac{R}{j\omega C R + 1} = \frac{R}{R} \cdot \frac{1}{j\omega C + \frac{1}{R}}$$

5, 14



$\omega = 10\ rad/sec$

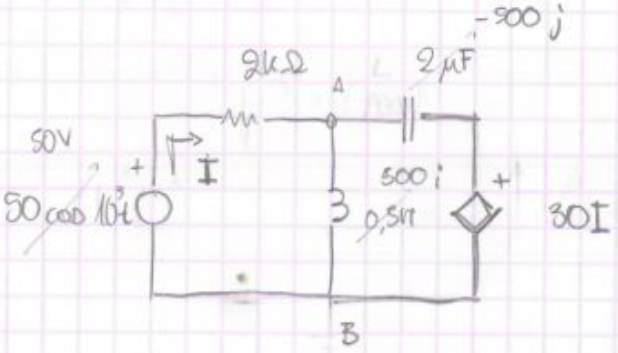
$$Req = \left[(j25 - j14) \,//\, 16\right] + j20 + 4$$

$$= 9,13 + j27,5$$

$$I(t) = \frac{V_S}{Req}$$

$$= \frac{12+0j}{9,13+j27,5} = 0,13 - 0,39j$$

5, 17



MILLMANN

$$V_{AB} = \frac{\frac{50}{2000} + \frac{30\,i}{-500\,j}}{\frac{1}{2000} + \frac{1}{500\,j} - \frac{1}{500\,j}}$$

$$= \frac{0,25 + 0,06\,j\,I}{\frac{1}{2000}} = 50 + 120\,j\,I$$

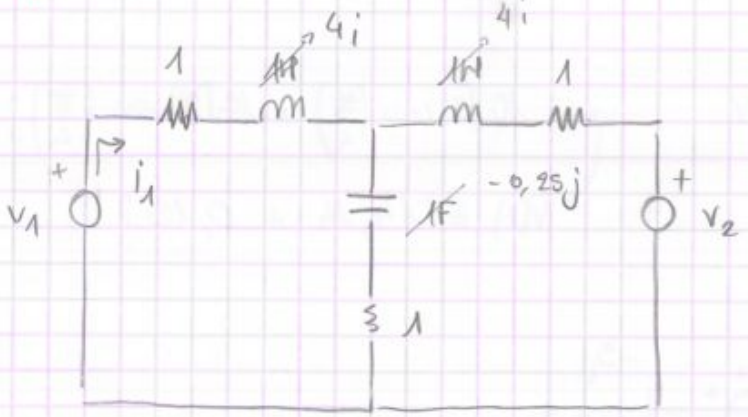
KCL (A) $I = 30I - V_{AB}$

$$= 30I - 50 + 120\,I\,j$$

$$50 = 30I - I + 120\,I\,j$$

$$I = \frac{50}{30 - 1 + 120\,j} =$$

5, 20

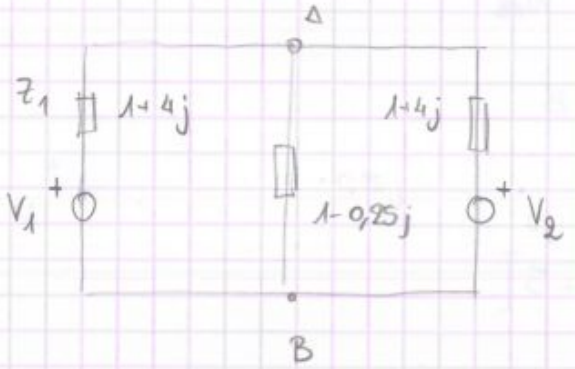


$V_1 = 10 \cos 4t \ V$

$\doteq 10 \ V$

$V_2 = 20 \cos(4t - 30)$

$= 17,3 - j10$



$$V_{AB} = \frac{V_1/1+4j + V_2/1+4j}{\frac{1}{1+4j} - \frac{1}{-0,25j} + \frac{1}{1+4j}} = \frac{15,53 - 2,94i}{1,06 - 0,24i}$$

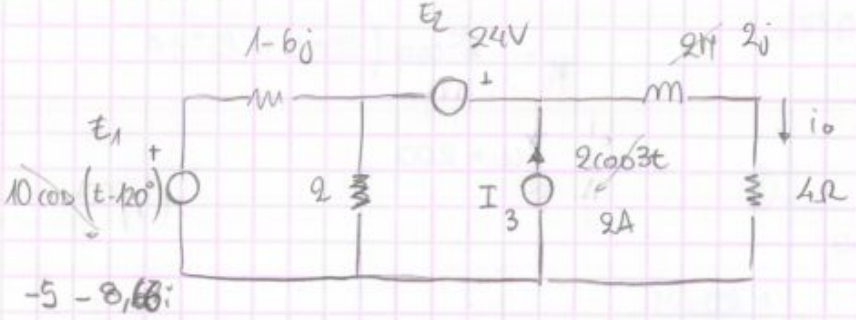
$= 14,93 + j\,0,51 \ V$

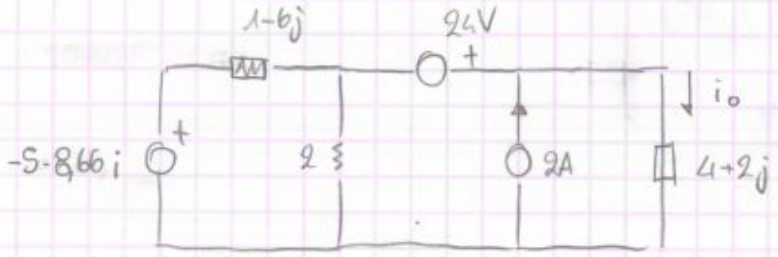
$$i = \frac{V_1 - V_{AB}}{R_1} = -0,38 + 1,04i$$

BOH

5, 22

$i_0(t) = ?$





SOVRAPP. EFFETTI

- $-5 - 8,66i$

Millmann

$$V_2 = \frac{\frac{-5-8,66j}{1-6j}}{\frac{1}{1-6j} + \frac{1}{2} + \frac{1}{4+2j}} = \frac{1,27 - 1,04i}{0,73 + 0,06j} = 1,61 - 1,57i$$

$$i_0 = 0,17 - 0,47j$$

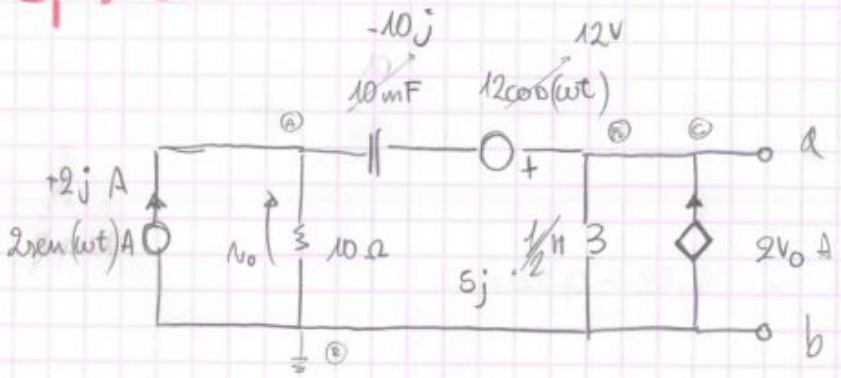
- $24V$

Millmann

$$V_2 = \frac{\frac{24}{4+2j}}{0,73+0,06j} = -6,26 + 3,80\,j$$

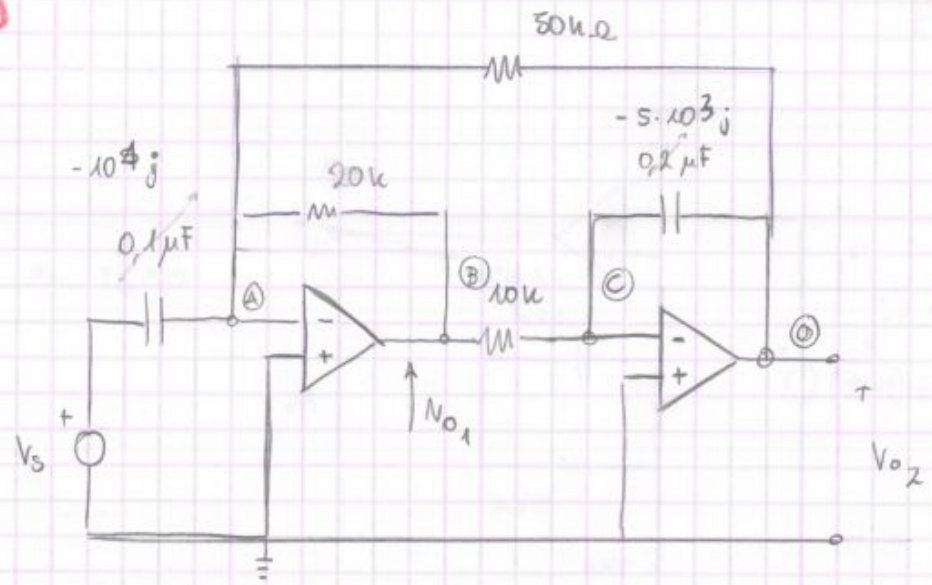
$$i_0 = -0,87 + 1,39i$$

5, 23



$\omega = 10$ rad/sec

5.25



$V_S = 4\cos(1000t - 60°)\ V$

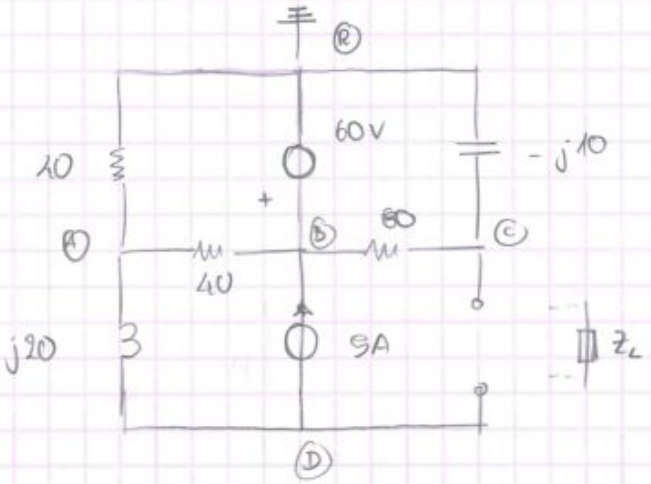
$= 2 - 1{,}73j$

È IMPOSTATO CORRETTAMENTE

$$\begin{cases} \dfrac{V_A - V_S}{-10^4 j} + \dfrac{V_A - V_D}{50k} + \dfrac{V_A - V_B}{20k} = 0 \\ \dfrac{V_B - V_A}{20k} + \dfrac{V_B - V_C}{10k} = 0 \\ \dfrac{V_C - V_B}{10k} + \dfrac{V_C - V_O}{-5\cdot10^{3} j} = 0 \\ \dfrac{V_O - V_A}{50k} + \dfrac{V_O - V_C}{-5\cdot10^{-3}} = 0 \end{cases}$$

$0{,}0001j\,V_A + 0{,}000173 + 0{,}0002i + \dfrac{V_A}{50k} - \dfrac{V_B}{50k} + \dfrac{V_A}{20k} - \dfrac{V_B}{20k} =$

5,27



PRIMA EQA DA FARE CA Req e POI IL TEOR. AI NODI per la pot dimm pieta

$V_B = 60\,V$ $\qquad$ $V_B = 60\,V$

(A) $\dfrac{V_A - V_B}{40} + \dfrac{V_A}{40} + \dfrac{V_A - V_D}{j20} = 0$

(C) $\dfrac{V_C}{-j10} + \dfrac{V_C - V_B}{80} = 0$ $\qquad$ $\dfrac{80V_C + j10V_C}{800j} = \dfrac{V_B}{80}$ $\qquad$ $V_C = 0,82 + 7,38j$

(D) $\dfrac{V_D - V_A}{j20} + 5 = 0$

$\dfrac{V_A}{20} - \dfrac{V_B}{40} + \dfrac{V_A}{j20} - \dfrac{V_D}{j20} = 0$ $\qquad$ $\dfrac{V_A}{20} - 1,5 + \dfrac{V_A}{j20} - \left(\dfrac{V_A}{j20} - 5\right) = 0$

$\dfrac{V_D}{j20} - \dfrac{V_A}{j20} + 5 = 0$ $\qquad$ $\dfrac{V_A}{20} + \dfrac{V_A}{j20} - \dfrac{V_A}{j20} + 5 - 1,5 = 0$

$V_D = \left(\dfrac{V_A}{j20} - 5\right) j20$ $\qquad$ $V_A = -70\,V$

$V_D = -70 - 100j$

$P = |V_{RMS}| \cdot |I_{RMS}| \cdot \cos\varphi$

$= 16'395\ W$

$\varphi = V_{AB}\hat{}\ I_{\Delta}$

$= 16'395\ W$

$\doteq -11,3°$

$\rightarrow P_{tot} = 3 \cdot P = 50\ KW$

$Q = |V_{RMS}| \cdot |I_{RMS}| \cdot \text{sen}|\varphi|$

$= +3'276\ VAR \rightarrow 3 \cdot 3'276 = 9,66\ VAR$

$\vec{S} = 50k + j\,9,6k\ \ VA$

$V = R \cdot I$

$P = V \cdot I$

$= RI^2$

$P_{CARICO} =$

$$\frac{V_{ab}}{Z_b} = \frac{389,2 \angle 21,2}{10,2 \angle -11^\circ} = 38 \angle 32 = I_\Delta$$

$$P = |V_{RMS}|\,|I_{RMS}| \cdot \cos\varphi$$

$$= 14'527 \ (\cdot 3) \rightarrow 43'583 \ W$$

$$Q = |V_{RMS}|\,|I_{RMS}| \cdot \sin\varphi$$

$$= 2'771,3 \ (\cdot 3) \rightarrow 8'313 \ VAR$$

$$S = 43'583 + 8'313j$$

3,39

$P_{TOT} = 5,6 \ kW$

$E = 220 \ V$

$I_{aA} = 18,2 \ A$

$$P/3 = E \cdot I_{aA} \cdot \cos\varphi$$

$$\cos\varphi = \frac{P}{3} \cdot \frac{1}{E I_{aA}} = 0,47$$

$P_A = 0$ W $\quad Q_A = |Z_d| \cdot |I_{dA}^2| \cdot \text{sen}\,\varphi$ $\quad$ (φ = angolo impedenza

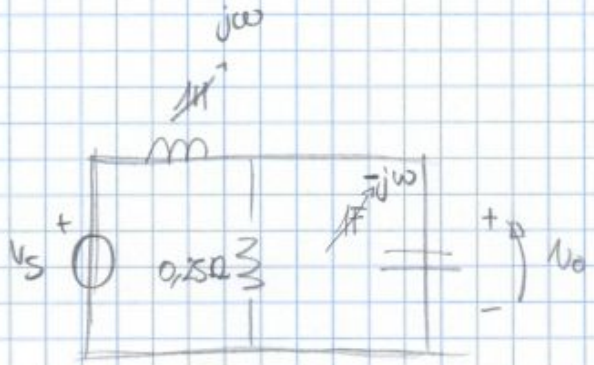
oppure

$= \dot{V} \hat{} \dot{I}$

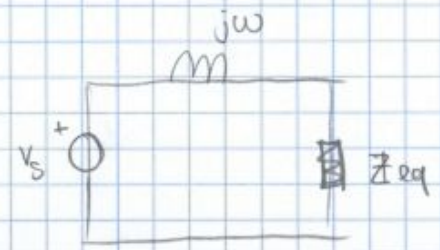
$= 72$ KVAR

5.44

$$H(s) = \frac{V_o}{V_s}$$



$$Z_{eq} = \frac{-j\omega \cdot 0{,}25}{0{,}25 - j\omega} = -\frac{+j\omega\ 0{,}25}{\left(1 - \frac{j\omega}{0{,}25}\right) 0{,}25}$$



$$V_o = V_s \cdot \frac{Z_{eq}}{j\omega + Z_{eq}}$$

$$\downarrow$$

$$H(s) = \frac{-s}{\left(1 - \frac{s}{0{,}25}\right)} \cdot \frac{1}{\left[s - \frac{+s}{\left(1 - \frac{s}{0{,}25}\right)}\right]}$$

$$= -\frac{s}{1-4s} \cdot \frac{1}{\left(s - \frac{s}{1-4s}\right) s}$$

$$= -\frac{1}{1-4s} \cdot \frac{1\ (1-4s)}{1 - \frac{1}{1-4s} + 1\ (1-4s)}$$

$$= -\frac{1}{1-4s} \cdot \frac{1}{-4s}$$

$$= \frac{1}{4s}$$

5,49

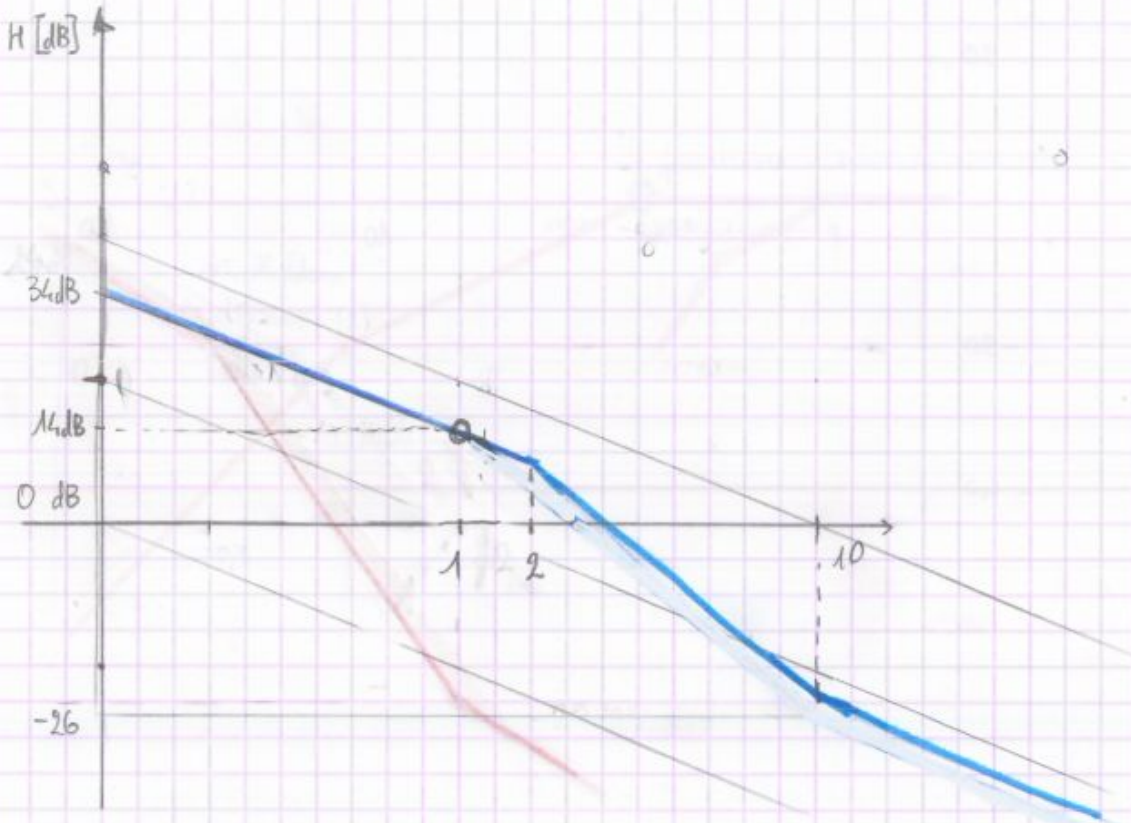
$$H(\omega) = \frac{10 + j\omega}{j\omega(2 + j\omega)}$$

$$= \frac{5 \times 10\left(1 + \frac{j\omega}{10}\right)}{j\omega \cdot 2\left(1 + \frac{j\omega}{2}\right)}$$

$$H(20) =$$

$$|5|_{dB} \rightarrow 20 \log_{10} |5| = 13,98 \simeq 14 \text{ dB}$$

	ω
ZERI	-10
POLI	0
	-2



5,51

$$H(s) = \frac{8(s+20)}{(s+1)(s^2+60s+1100)}$$