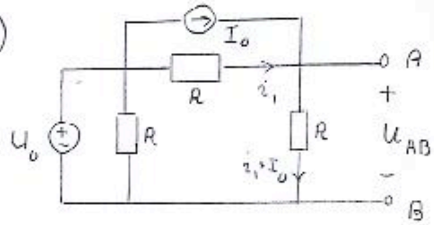
Elektriska kretsar för Z1, 10/1 2006

(1)

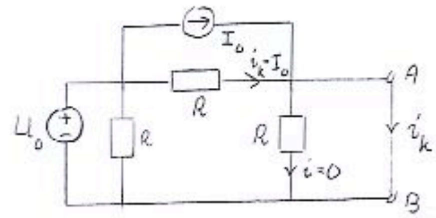


tomgång: KVL:

$U_0 - Ri_1 - R(i_1 + I_0) = 0$

$i_1 = \frac{1}{2R}(U_0 - RI_0)$

$\underline{U_{AB}} = Ri_1 + RI_0 = \underline{\frac{1}{2}(RI_0 + U_0)}$

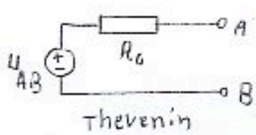


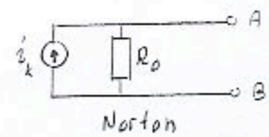
kortslutning: KVL:

$U_0 - R(i_k - I_0) = 0$

$\underline{i_k} = \underline{\frac{1}{R}(RI_0 + U_0)}$

Ekv. tvåpol:





$\underline{R_0} = \frac{U_{AB}}{i_k} = \underline{\frac{R}{2}}$

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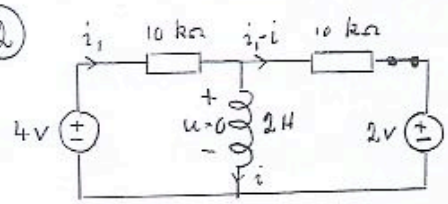
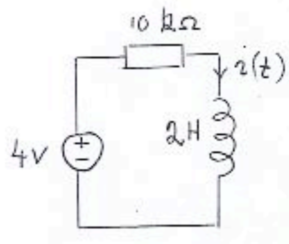
(2)



a) $\underline{t = 0^-}$: KVL: $\begin{cases} 4 = 10^4 i_1 \\ 2 = -10^4(i_1 - i) \end{cases}$

$2 = -4 + 10^4 i \rightarrow \underline{i = 6 \cdot 10^{-4}\,A}$



b) $\underline{t \geq 0}$: KVL: $4 = 10^4 i + 2\frac{di}{dt}$

Lösning till homogena ekv: $10^4 i_h = -2\frac{di_h}{dt}$

$i_h = Ce^{-(10^4/2)t}$, C = integrationskonst.

partikulärlösning: $i_p = \text{konst.} = 4 \cdot 10^{-4}\,A$

$i = i_h + i_p = Ce^{-(10^4/2)t} + 4 \cdot 10^{-4}$, Begynnelsevillkor:

$i = 6 \cdot 10^{-4}\,A$ för $t = 0 \rightarrow C + 4 \cdot 10^{-4} = 6 \cdot 10^{-4} \rightarrow C = 2 \cdot 10^{-4} \rightarrow$

$\rightarrow \underline{i = 2 \cdot 10^{-4}\left(2 + e^{-(10^4/2)t}\right)\,A}$

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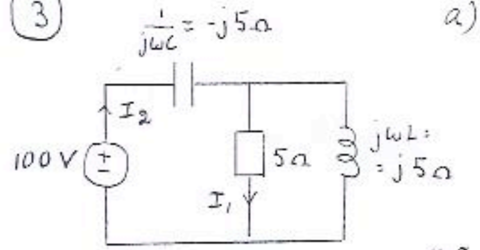
(3)



a) Ohms lag: $\underline{I_2} = \dfrac{100}{-j5 + \dfrac{j5\cdot 5}{j5+5}} = \dfrac{100}{\dfrac{5-j5+j5}{1+j}} = 20(1+j)\ A = \underline{20\sqrt{2}\ e^{j45°}\ A}$

Strömdelning: $\underline{I_1} = \dfrac{j5}{j5+5} I_2 = 20j = \underline{20e^{j90°} A}$

b) $\underline{i_2} = \mathrm{Re}\left(I_2 e^{j\omega t}\right) = \underline{20\sqrt{2}\cos(100t+45°)\,A}$, $\underline{i_1} = \mathrm{Re}\left(I_1 e^{j\omega t}\right) = \underline{20\cos(100t+90°)\,A}$

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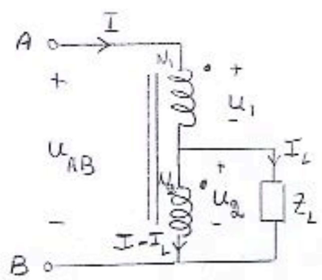
(4)



$\dfrac{u_1}{u_2} = \dfrac{N_1}{N_2}$, $\dfrac{I}{I-I_L} = -\dfrac{N_2}{N_1} \rightarrow I_L = \left(1+\dfrac{N_1}{N_2}\right) I$

$u_{AB} = u_1 + u_2 = \left(1+\dfrac{N_1}{N_2}\right) u_2 = \left(1+\dfrac{N_1}{N_2}\right) I_L Z_L$

$= \left(1+\dfrac{N_1}{N_2}\right)\left(1+\dfrac{N_1}{N_2}\right) I Z_L$

$\underline{Z_{in} = \dfrac{u_{AB}}{I} = \left(1+\dfrac{N_1}{N_2}\right)^2 Z_L}$

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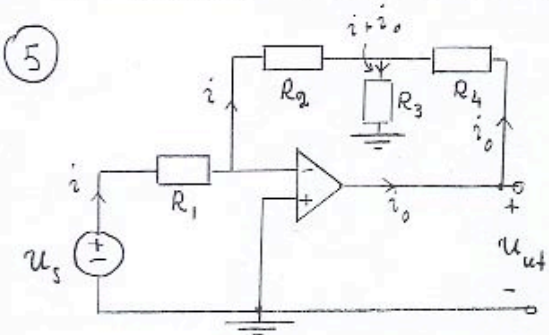
(5)



KVL: $u_{ut} - u_s + (R_1+R_2)i - R_4 i_0 = 0$

$u_s = R_1 i \rightarrow i = u_s / R_1$

$R_2 i + R_3(i+i_0) = 0 \rightarrow$

$\rightarrow i_0 = -\dfrac{R_2+R_3}{R_3} i =$

$= -\dfrac{R_2+R_3}{R_1R_3} u_s$

$\therefore\ u_{ut} - u_s + \dfrac{R_1+R_2}{R_1} u_s + \dfrac{R_4(R_2+R_3)}{R_1R_3} u_s = 0$

$\rightarrow \underline{\dfrac{u_{ut}}{u_s}} = 1 - 1 - \dfrac{R_2}{R_1} - \dfrac{R_4(R_2+R_3)}{R_1R_3} = \underline{-\dfrac{R_2R_3 + R_4R_2 + R_4R_3}{R_1R_3}}$

A.J.