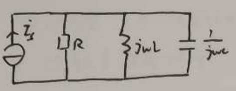
1. 解:



$Y_{eq} = \frac{1}{R} + \frac{1}{j\omega L} + j\omega C$

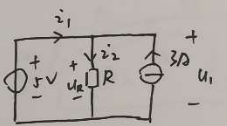
$= \frac{1}{R} - j\frac{1}{\omega L} + j\omega C$

发生并联谐振时.

$-j\frac{1}{\omega_0 L} + j\omega_0 C = 0$

$\omega_0 = \sqrt{\frac{1}{LC}}$

2. 解:



由KCL和KVL得:

$i_1 + 3 = i_2$

$5 = i_2 R = (i_1+3)R$

当 $i_1 > 0$ 时, 电压源发出功率

即 $i_1 = \frac{5}{R} - 3 > 0$

$R < \frac{5}{3}\Omega$ 时. 电压源发出功率

$R > \frac{5}{3}\Omega$ 时. 电压源吸收功率

∴ 5V电压源不确定是吸收还是发出功率

$U_R = i_2 R = (i_1+3)R$

电阻恒为吸收功率.

可知 $U_1 = U_R$

当 $U_R = (i_1+3)R > 0$

即 $i_1 + 3 > 0$

$i_1 > -3A$ 时

电流源发出功率

~~当 $i_1 < -3A$ 时~~

~~电流源吸收功率~~

~~∴ 3A电流源的功率情况不确定~~

即 $i_1 = \frac{5}{R} - 3 > -3$

又 ∵ $\frac{5}{R} > 0$. 恒成立

∴ 电流源是发出功率.

综上: 5V电压源功率情况不确定

电阻R吸收功率

3A电流源发出功率.

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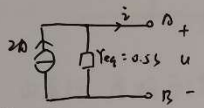
3. 解：由题知得 $i=-0.5u+2$

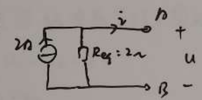
∴ 诺顿等效电路中

$i_{sc}=2A$.　$Y_{eq}=-0.5S$

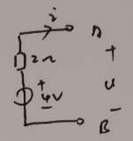
如图所示



等效为



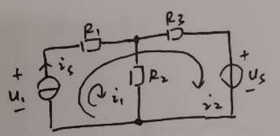
∴ 其戴维宁等效电路为



∴ $u_{oc}=4V$

$R_i=2\Omega$.

4. 解：



$$\begin{cases}(R_1+R_2)i_1+R_1i_2=u_1\\(R_1+R_3)i_2+R_1i_1=u_1-u_s\\i_1+i_2=i_s\end{cases}$$

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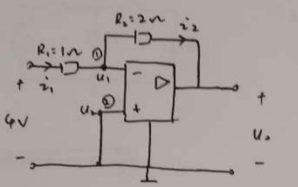
5. 解:



由虚短、虚断可得

结点①处电压与结点②处电压相等

$u_1=u_2=0V$

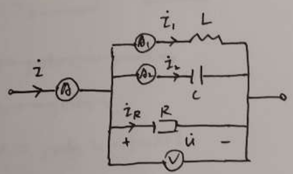
$i_1=i_2$

$i_1=\dfrac{4-u_1}{R_1}$　　$i_2=\dfrac{u_1-u_0}{R_2}$

$\dfrac{4-0}{1}=\dfrac{0-u_0}{2}$

$u_0=-8V$

6. 解:



$\because U_R=220V$　$R=550\Omega$

$\therefore I_R=\frac{2}{5}A$.

设 $\dot{I}_R=\frac{2}{5}\angle 0^\circ A$

$\dot{U}=220\angle 0^\circ V$

$\because \dot{I}_C=j\omega C\dot{U}_C$

$\dot{U}_L=j\omega L\dot{I}_L$, $\dot{I}_L=-j\frac{1}{\omega L}\dot{U}_L$

$\therefore \dot{I}_2=1\angle 90^\circ A$.

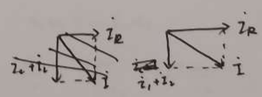
$\dot{U}_C=\dot{U}_L$

$\because \omega L<\frac{1}{\omega C}$

$\therefore \frac{1}{\omega L}>\omega C$. $\dot{I}_L=\dot{I}_1$, $\dot{I}_C=\dot{I}_2$

$\therefore \omega C-\frac{1}{\omega L}<0$

$\therefore \dot{I}_C+\dot{I}_L=\dot{U}j(\omega C-\frac{1}{\omega L})$



$\dot{I}=\dot{I}_C+\dot{I}_L+\dot{I}_R=\dot{I}_1+\dot{I}_2+\dot{I}_R$

由图可得

$\therefore \dot{I}_C+\dot{I}_L=0.3\angle -90^\circ A$

$\therefore \dot{I}_L=\dot{I}_1=1.3\angle -90^\circ A$

~~∴ A1 = 1.3 A.~~

$\therefore A_1=I_1=1.3A$

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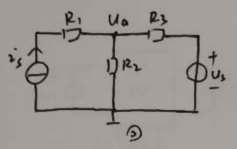
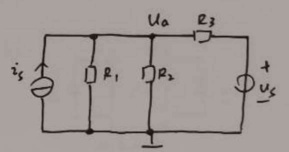
7.解：(a)



$\cancel{(R_2+R_3)u_a = i_s + \frac{u_s}{R_3}}$

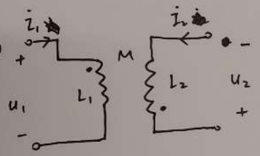
$(\frac{1}{R_2}+\frac{1}{R_3})u_a = i_s + \frac{u_s}{R_3}$

(b)



$(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3})u_a = i_s + \frac{u_s}{R_3}$

8.解：(a)



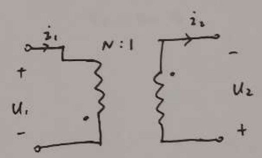
$\cancel{u_1 = j\omega L_1 i_1 - j\omega M i_2}$

$\cancel{u_2 = -j\omega L_2 i}$

$\dot{U}_1 = j\omega L_1 \dot{I}_1 - j\omega M \dot{I}_2$

$\dot{U}_2 = -j\omega L_2 \dot{I}_2 + j\omega M \dot{I}_1$

(b)



由图可知

$\frac{u_1}{u_2} = \frac{N}{1} = N$

$\frac{i_1}{i_2} = -\frac{1}{N}$

$\therefore \frac{i_1}{i_2} = -\frac{1}{N} = -\frac{u_2}{u_1}$

$i_1 u_1 = -i_2 u_2$

$\frac{u_1}{i_1} = \frac{Nu_2}{-\frac{1}{N}i_2} = -N^2\frac{u_2}{i_2}$

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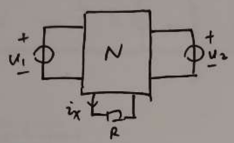
9. 解：(a)



由线性特性知：

$$\begin{cases} 2a+3b=20 \\ -2a+b=0 \end{cases}$$

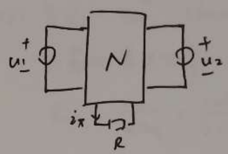
解得：$a=2.5$，$b=5$

$\therefore \quad 5a+5b=37.5$

即 $u_1=u_2=5V$ 时

$i_x=37.5A$.

(b)



由线性特性知

$$\begin{cases} 2a+3b+c=20 \\ -2a+b+c=0 \\ c=-10 \end{cases}$$

解得：$a=0$　$b=10$，$c=-10$

$\therefore \quad 5a+5b+c=40$

即 $u_1=u_2=5V$ 时

$i_x=40A$.

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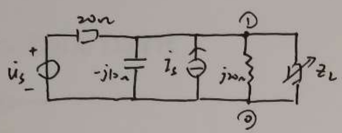
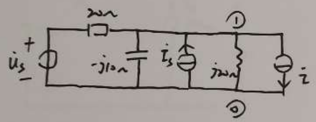
10. 解：(1)



~~$\frac{1}{20}+\frac{1}{-j10}+\frac{1}{j20}$~~

$(\frac{1}{20}+\frac{1}{-j10}+\frac{1}{j20}+\frac{1}{Z_L})\dot U_1 = \frac{\dot U_s}{20}+\dot I_s$

(2) 将 Z_L 替换成电流为 $\dot I$ 的电流源得到电路：



对结点①列结点电压方程：

$(\frac{1}{20}+\frac{1}{-j10}+\frac{1}{j20})\dot U_1 = \frac{\dot U_s}{20}+\dot I_s-\dot I$

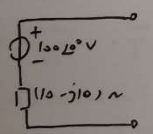
$\dot U_1 = 100-(10-j10)\dot I$

∴ 戴维宁等效电路中

$\dot U_{oc}=100\angle 0^\circ V$

~~Req~~ $Z_{eq}=(10-j10)\Omega$

∴ 从 Z_L 端口看进去的戴维南等效电路为

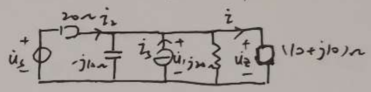


(3) 当 $Z_L=Z_{eq}^*=(10+j10)\Omega$ 时，

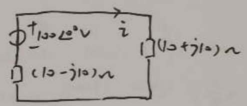
Z_L 获得最大功率

$P_{max}=\frac{U_{oc}^2}{4R_{eq}}=\frac{100^2}{4\times10}W=250W$

(4) 当 Z_L 获得最大功率时，$Z_L=(10+j10)\Omega$



电路的戴维南等效电路为



$\dot I=\frac{100}{20}A=5\angle 0^\circ A$

∴ $\dot U_1=\dot U_2=\dot I Z_L=(50+j50)V$

∴ 电流源发出的复功率 $\bar S_1$

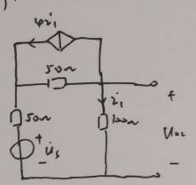
$\bar S_1=\dot U_1\dot I_s^*=(250+j250)V\cdot A$

$\dot I_2=\frac{\dot U_s-\dot U_1}{20}=(-2.5+j2.5)A$

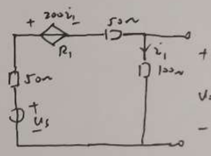
电压源发出的复功率 $\bar S_2$

$\bar S_2=\dot U_s\dot I_2^*=(250-j250)V\cdot A$

11. 解：先求戴维南等效电路

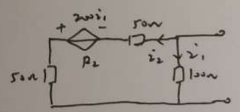


等效于



$$R_1 = \frac{200i_1}{i_1} = 200\Omega$$

$$u_{oc} = \frac{u_s \times 100}{200+100+50\times 2} = \frac{1}{4}u_s$$



$$100i_1 = 100i_2 - 200i_1$$

$$300i_1 = 100i_2$$

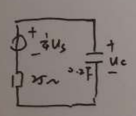
$$i_2 = 3i_1$$

$$R_2 = \frac{-200i_1}{i_2} = -\frac{200}{3}\Omega$$

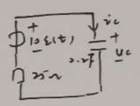
$$-\frac{200}{3}\Omega + 50\Omega + 50\Omega = \frac{100}{3}\Omega$$

$$R_{eq} = \frac{\frac{100}{3}\times 100}{\frac{100}{3}+100} = 25\Omega$$

∴ 戴维南等效电路为



(1) $u_s = 40\varepsilon(t)$. $\frac{1}{4}u_s = 10\varepsilon(t)$



由换路定则 $u_c(0_+) = u_c(0_-) = 0V$

$u_c(\infty) = 10\varepsilon(t) = 10V$

$u_c(t) = u_c(\infty) + (u_c(0_+) - u_c(\infty))e^{-\frac{t}{\tau}}$

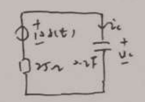
$\tau = RC = 5s$

$u_c(t) = 10 - 10e^{-\frac{t}{5}}$ (V)　($t \geq 0_+$)

$\therefore u_c(t) = 10(1-e^{-\frac{t}{5}})\varepsilon(t)$ (V)

$i_c(t) = \frac{10\varepsilon(t) - u_c(t)}{25} = \frac{2}{5}e^{-\frac{t}{5}}\varepsilon(t)$ (A)

(2) $u_s = 40\delta(t)$. $\frac{1}{4}u_s = 10\delta(t)$



$10\delta(t) = 25i_c + u_c$

$10\delta(t) = 25C\frac{du_c}{dt} + u_c$

两边积分.

$\int_{0^-}^{0^+} 10\delta(t)dt = \int_{0^-}^{0^+} 25C\frac{du_c}{dt}\cdot dt + \int_{0^-}^{0^+} u_c dt$

$10 = 5(u_c(0_+) - u_c(0_-)) + 0$

$u_c(0_+) = 2V$

$t \geq 0_+$ 时. 电路为零输入响应

$\tau = RC = 5s$

$u_c(t) = 2e^{-\frac{t}{5}}\varepsilon(t)$

$i_c(t) = \frac{10\delta(t) - u_c}{25}$

$= \frac{10\delta(t) - 2e^{-\frac{t}{5}}\varepsilon(t)}{25}$ A

$= \frac{2}{5}\delta(t) - \frac{2}{25}e^{-\frac{t}{5}}\varepsilon(t)$ (A)