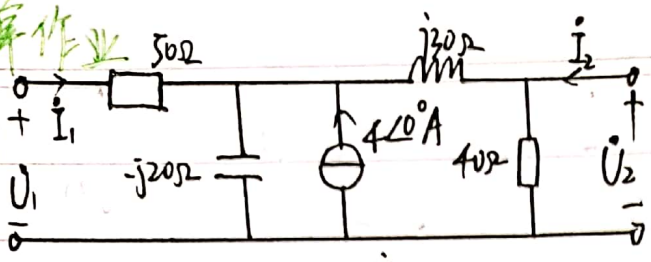
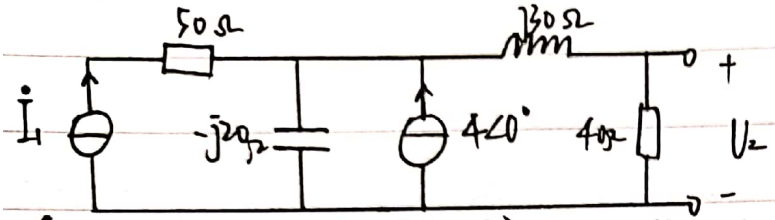
第十六章作业

[16-2]

(1)





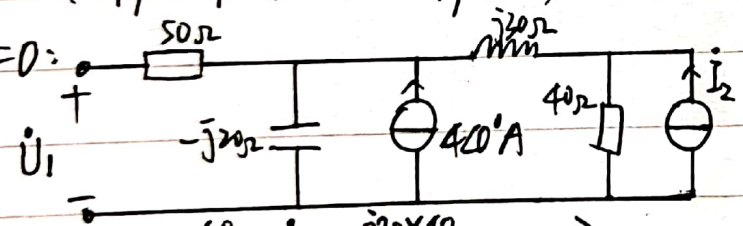
$\dot{I}_2=0$: $\dot{U}_1=(50-\frac{-j20(j30+40)}{j10+40})\dot{I}_1-\frac{-j20(j30+40)}{j10+40}\times 4\angle 0°$

$=(\frac{1010}{17}-j\frac{380}{17})\dot{I}_1-4(-\frac{160}{17}+j\frac{380}{17})$

$=(\frac{1010}{17}-j\frac{380}{17})\dot{I}_1+(\frac{640}{17}-j\frac{1520}{17})$

$\dot{U}_2=40\times(\frac{-j20}{j10+40}\dot{I}_1-\frac{-j20}{j10+40}\times 4\angle 0°)$

$=(-\frac{80}{17}-\frac{320}{17})\dot{I}_1+(\frac{-320-j1280}{17})$



$\dot{U}_1=-j20\times(\frac{40}{j10+40}\dot{I}_2+\frac{j30\times 40}{j10+40}\times 4\angle 0°)$

$=(-\frac{80}{17}-j\frac{320}{17})\dot{I}_2+(\frac{640}{17}-j\frac{1520}{17})$

$\dot{U}_2=\frac{40\times j10}{40+j10}\dot{I}_2+\frac{-j20}{j10+40}\times 4\angle 0°\times 40$

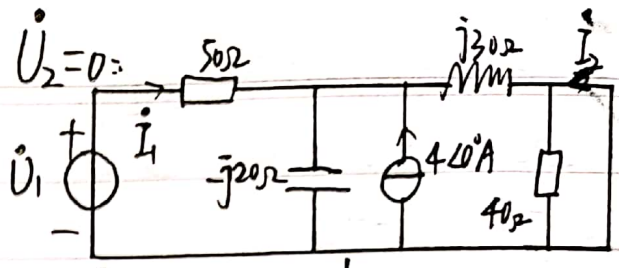
$=(\frac{40}{17}+j\frac{160}{17})\dot{I}_2+(\frac{-320-j1280}{17})$

$\therefore\begin{cases}\dot{U}_1=Z_{11}\dot{I}_1+Z_{12}\dot{I}_2+(\frac{640}{17}-j\frac{1520}{17})\\ \dot{U}_2=Z_{21}\dot{I}_1+Z_{22}\dot{I}_2+(\frac{-320}{17}-j\frac{1280}{17})\end{cases}$

$Z_{11}=\frac{1010}{17}-j\frac{380}{17}$ $Z_{12}=-\frac{80}{17}-j\frac{320}{17}$

$Z_{21}=-\frac{80}{17}-j\frac{320}{17}$ $Z_{22}=\frac{40}{17}+j\frac{160}{17}$

(2) $\dot{U}_2=0$:



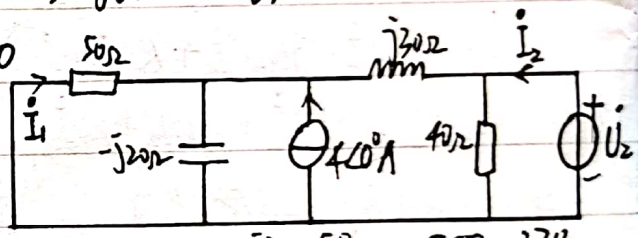
$\dot{I}_1=\frac{\dot{U}_1}{50+\frac{-j20\times j30}{j10}}-\frac{\frac{1}{50}}{\frac{1}{50}+\frac{1}{-j20}+\frac{1}{j30}}\times 4\angle 0°$

$=\frac{\dot{U}_1}{50-j60}+(-\frac{144}{61}+j\frac{120}{61})$

$-\dot{I}_2=\frac{j30}{j10}\times\frac{\dot{U}_1}{50+\frac{-j20\times j30}{j10}}+\frac{\frac{1}{j30}}{\frac{1}{50}+\frac{1}{-j20}+\frac{1}{j30}}\times 4\angle 0°$

$\therefore\dot{I}_2=\frac{-3U_1}{50-j60}+\frac{200+j240}{61}$

$\dot{U}_1=0$



$Z_{eq1}=j30+\frac{-j20\times 50}{-j20+50}=-\frac{200}{29}+j\frac{370}{29}$

$Z_{并}=\frac{(\frac{-200}{29}+j\frac{370}{29})\times 40}{\frac{-200}{29}+j\frac{370}{29}+40}=-\frac{152}{73}+j\frac{1184}{73}$

$\therefore\dot{I}_2=\frac{\dot{U}_2}{-\frac{152}{73}+j\frac{1184}{73}}-\frac{\frac{1}{j30}}{\frac{1}{50}+\frac{1}{j30}+\frac{1}{-j20}}\times 4\angle 0°$

$=\frac{\dot{U}_2}{-\frac{152}{73}+j\frac{1184}{73}}+\frac{200+j240}{61}$

$\dot{I}_1=\frac{j20}{50-j20}\times\frac{40}{40+Z_{eq1}}\dot{I}_2-\frac{\frac{1}{50}}{\frac{1}{50}-\frac{1}{j20}+\frac{1}{j30}}\times 4\angle 0°$

$=\frac{j20}{50-j20}\times\frac{40}{40+Z_{eq1}}\times\frac{\dot{U}_2}{-\frac{152}{73}+j\frac{1184}{73}}+\frac{-144+j120}{61}$

$\therefore\begin{cases}\dot{I}_1=Y_{11}\dot{U}_1+Y_{12}\dot{U}_2+(\frac{-144}{61}+\frac{j120}{61})\\ \dot{I}_2=Y_{21}\dot{U}_1+Y_{22}\dot{U}_2+(\frac{200}{61}+j\frac{240}{61})\end{cases}$

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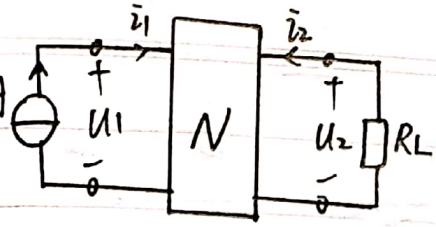
[16-11] 1A



(1) ∵ N为对称二端口网络

∴ $Z_{12}=Z_{21}$, $Z_{11}=Z_{22}$

$$\begin{cases} u_1=Z_{11}i_1+Z_{12}i_2 \\ u_2=Z_{21}i_1+Z_{22}i_2 \end{cases}$$

$R_L=\infty$ 时, $i_2=0$ ∴ $\begin{cases} 16=Z_{11}i_1 \\ 6=Z_{21}i_1 \end{cases}$ 又 $i_1=1A$

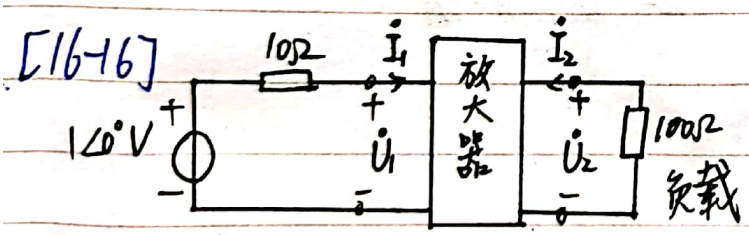
∴ $Z_{11}=16\Omega$, $Z_{21}=6\Omega$, $Z_{12}=6\Omega$, $Z_{22}=16\Omega$

∴ $Z=\begin{bmatrix} 16\Omega & 6\Omega \\ 6\Omega & 16\Omega \end{bmatrix}$

(2) $R_L=0$ 时, $u_2=0$

∴ $\begin{cases} u_1=16+6i_2 \\ 0=6+16i_2 \end{cases}$ ∴ $\begin{cases} u_1=\frac{55}{4}V \\ u_2=-\frac{3}{8}A \end{cases}$

[16-16]



$$\begin{cases} \dot I_1=Y_{11}\dot U_1+Y_{12}\dot U_2 \\ \dot I_2=Y_{21}\dot U_1+Y_{22}\dot U_2 \end{cases} \Rightarrow \begin{cases} \dot I_1=25\times10^{-3}\dot U_1-1\times10^{-3}\dot U_2 \\ \dot I_2=-250\times10^{-3}\dot U_1-40\times10^{-3}\dot U_2 \end{cases}$$

又 $\begin{cases} 1\angle0^\circ=10\dot I_1+\dot U_1 \\ \dot U_2=-100\dot I_2 \end{cases}$

∴ $\begin{cases} \dot I_1=25\times10^{-3}(1\angle0^\circ-10\dot I_1)+0.1\dot I_2 \\ \dot I_2=-0.25(1\angle0^\circ-10\dot I_1)+4\dot I_2 \end{cases}$

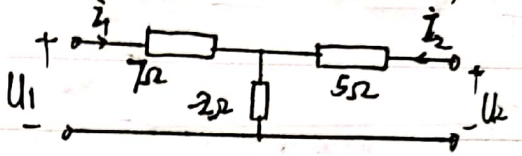
$\Rightarrow \dot I_1=0.025A$, $\dot I_2=0.0625A$

$=25mA$ $=62.5mA$

[16-26] (1) ∵ $Z_{12}=Z_{21}=-2$

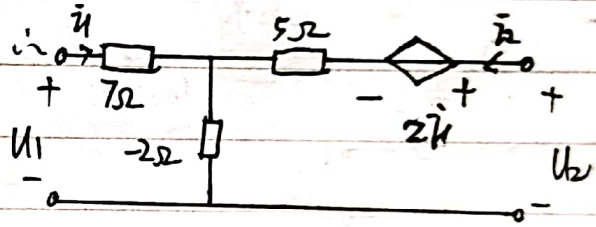
∴ 为互易二端口网络

$$\begin{cases} U_1=5I_1-2I_2=7I_1-2(I_1+I_2) \\ U_2=-2I_1+3I_2=-2(I_1+I_2)+5I_2 \end{cases}$$

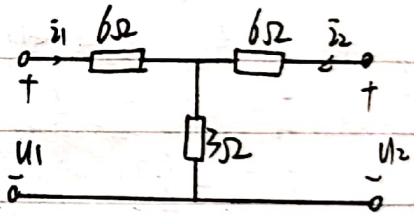


(2) ∵ $Z_{12}\neq Z_{21}$ ∴ 含有受控源

$$\begin{cases} u_1=5i_1-2i_2 \\ u_2=3i_2 \end{cases}$$



[16-30] (1)



$$\begin{cases} u_1=6i_1+3(i_1+i_2)=9i_1+3i_2 \\ u_2=6i_2+3(i_1+i_2)=3i_1+9i_2 \end{cases}$$

$$\Rightarrow \begin{cases} u_1=3(u_2-9i_2)+3i_2=3u_2+24(-i_2) \\ i_1=\frac{1}{3}u_2+3(-i_2) \end{cases}$$

∴ $T_2=\begin{bmatrix} 3 & 24\Omega \\ \frac{1}{3}S & 3 \end{bmatrix}$

(2) 两个二端口网络级联 ∴

$$T=T_1\times T_2=\begin{bmatrix} 2 & 30\Omega \\ 0.1S & 2 \end{bmatrix}\times\begin{bmatrix} 3 & 24\Omega \\ \frac{1}{3}S & 3 \end{bmatrix}=\begin{bmatrix} 16 & 138\Omega \\ \frac{29}{30}S & 8.4 \end{bmatrix}$$

即 $\begin{cases} U_1=16U_2+138I_2 \\ I_1=\frac{29}{30}U_2+8.4I_2 \end{cases}$

$I_2=0$ 时, $\frac{U_2}{U_1}=\frac{1}{16}$

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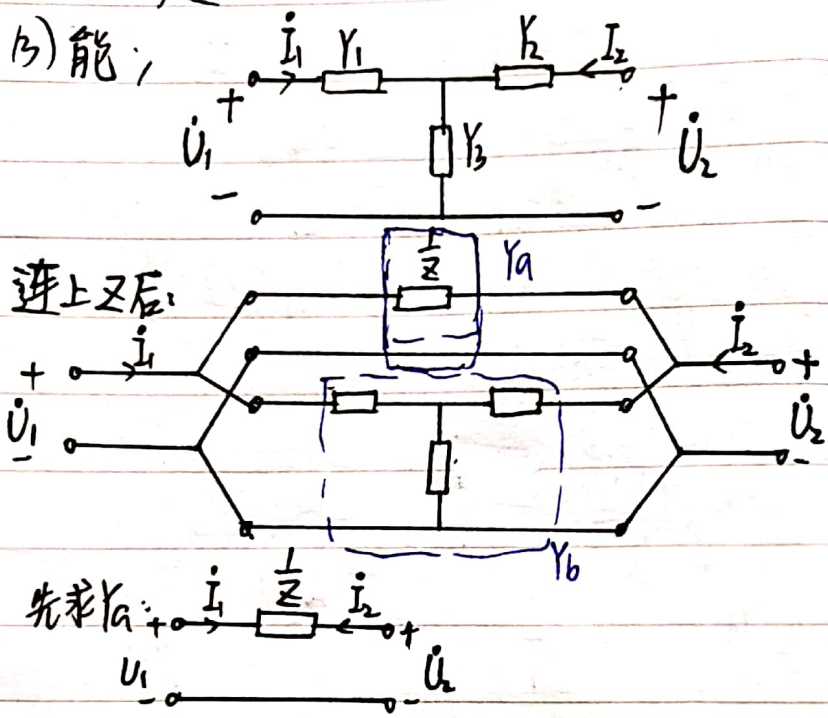
[16-36] (1) 原端口条件不变时，连上阻抗之后还是二端口网络，否则不是

(2) 是

(3) 能；



先求 Y_a：

知 $\dot{U}_2=0$ 时，$I_1=\frac{1}{2}\dot{U}_1$，$I_2=-\frac{1}{2}\dot{U}_1$

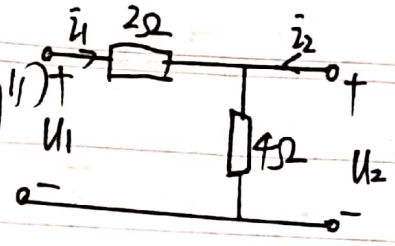
$\dot{U}_1=0$ 时，$I_1=-\frac{1}{2}\dot{U}_2$，$I_2=\frac{1}{2}\dot{U}_2$

$\therefore Y_a=\begin{bmatrix}\frac{1}{2} & -\frac{1}{2}\\ -\frac{1}{2} & \frac{1}{2}\end{bmatrix}$

设 $Y_b=\begin{bmatrix}Y_{11} & Y_{12}\\ Y_{21} & Y_{22}\end{bmatrix}$

并联，$Y=Y_a+Y_b=\begin{bmatrix}Y_{11}+\frac{1}{2} & Y_{12}-\frac{1}{2}\\ Y_{21}-\frac{1}{2} & Y_{22}+\frac{1}{2}\end{bmatrix}$

[16-38] (1)



由KCL、KVL：$\begin{cases}\dot{U}_1=2\dot{I}_1+4(\dot{I}_1+\dot{I}_2)=6\dot{I}_1+4\dot{I}_2\\ \dot{U}_2=4(\dot{I}_1+\dot{I}_2)\end{cases}$

$\therefore \dot{U}_1=6\cdot(\frac{\dot{U}_2}{4}-\dot{I}_2)+4\dot{I}_2=\frac{3}{2}\dot{U}_2+2(-\dot{I}_2)$

$\dot{I}_1=\frac{1}{4}\dot{U}_2+1\cdot(-\dot{I}_2)$

$\therefore T_a=\begin{bmatrix}\frac{3}{2} & 2\Omega\\ \frac{1}{4}S & 1\end{bmatrix}$

(2) 两个二端口网络级联

$T=T_a\times T_b=\begin{bmatrix}\frac{3}{2} & 2\Omega\\ \frac{1}{4}S & 1\end{bmatrix}\times\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}=\begin{bmatrix}\frac{3}{2} & 2\Omega\\ \frac{1}{4}S & 1\end{bmatrix}$

(3) 知：$\begin{cases}\dot{U}_1=\frac{3}{2}\dot{U}_2+2(-\dot{I}_2)\\ \dot{I}_1=\frac{1}{4}\dot{U}_2+1\cdot(-\dot{I}_2)\end{cases}$

$\dot{U}_1=10V$，$\dot{U}_2=0$ 时，

$\dot{I}_2=-5A$，$\dot{I}_1=5A$

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