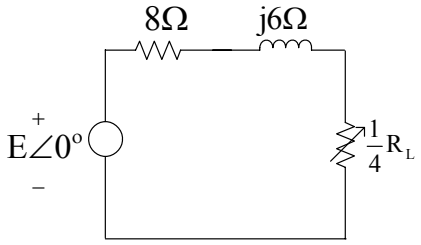
第六篇　最大功率傳輸 練習題解答

1. (A)　將阻抗歸至一次側可得下圖



當 $\frac{1}{4}R_L = |8 + j6|$ 時可得最大功率傳輸

$$\frac{1}{4}R_L = \sqrt{8^2 + 6^2} = 10$$

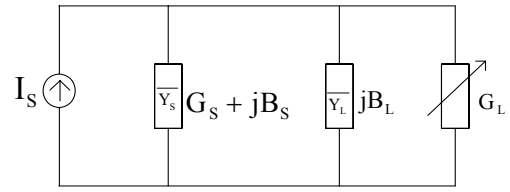
$$R_L = 40$$

2. (D)　將負載端開路，可得看入之等效阻抗 Z_{Th}

$$Z_{Th} = 1 // j = \frac{1}{2} + j\frac{1}{2}$$

當 $Z_L = Z_{Th}^* = \frac{1}{2} - j\frac{1}{2}$ 可得最大功率傳輸

3. (B)　原電路可得下圖等效電路



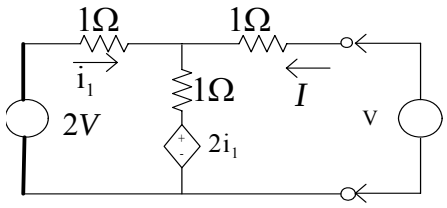
因B_L固定，可視爲已知歸至Y_S處，
則G_L依最大功率傳輸定理，可得

$$G_L = |G_S + j(B_S + B_L)|$$
$$= \sqrt{G_S{}^2 + (B_S + B_L)^2}$$

4. (D)　因 $\theta_L = 60°$ 爲固定值，由最大功率傳輸定理知，當 $|Y_L| = |Y_S|$ 時可得最大功率傳輸，即

$$|Y_L| = |Y_S| = \sqrt{G_S + B_S{}^2}$$
$$Y_L = |Y_L| \angle 60^o = |Y_L| \cos 60^o + j|Y_L| \sin 60^o = G_L + jB_L$$
$$G_L = |Y_L| \cos 60^o = \frac{1}{2}|Y_L|$$
$$G_L = \frac{1}{2}\sqrt{G_S{}^2 + B_S{}^2}$$

5. (A)



由網目分析

$$\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}\begin{bmatrix}i_1\\ I\end{bmatrix}=\begin{bmatrix}2-2i_1\\ V-2i_1\end{bmatrix}\ ,\quad \begin{bmatrix}4 & 1\\ 3 & 2\end{bmatrix}\begin{bmatrix}i_1\\ I\end{bmatrix}=\begin{bmatrix}2\\ V\end{bmatrix}$$

$$I=\frac{\begin{bmatrix}4 & 2\\ 3 & V\end{bmatrix}}{\begin{bmatrix}4 & 1\\ 3 & 2\end{bmatrix}}=\frac{4}{5}V-\frac{6}{5}\ ,\ \mathrm{V}=\frac{5}{4}I+\frac{3}{2}$$

$$\mathrm{R_{Th}}=\frac{5}{4}\Omega=\mathrm{R_{ab}}\quad ,\quad \mathrm{V_{Th}}=\frac{3}{2}V$$

6. (D)

由最大功率傳輸定理知，當$\mathrm{R_L}=\mathrm{R}_{in}=\frac{5}{4}$可得$\mathrm{P_{max}}$

$$\mathrm{P_{max}}=\left[\frac{\frac{3}{2}}{\frac{5}{4}+\frac{5}{4}}\right]^2\times\frac{5}{4}=0.45(W)$$

7. (C)

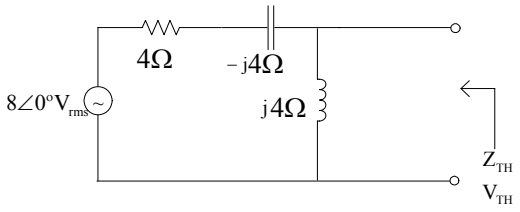
當 $R_L=|Z|=\sqrt{40^2+30^2}=50\,\Omega$ 時，可得最大功率傳輸。

8. (C)

欲得最大功率傳輸，負載 $Z_L=Z_{Th}{}^*=8-j4\Omega$

$$P_{\max}=(\frac{160}{8+8})^2\times 8=800\ (W)$$

9. (B)



$$Z_{Th}=j4//(4-j4)=4+j4$$
$$Z_L=Z_{Th}{}^*=4-j4\Omega$$
$$V_{Th}=\frac{j4}{4-j4+j4}\times 8=8\angle 90^o$$

10. (C)

$$P_{\max} = (\frac{8}{4+4})^2 \times 4 = 4\,(W)$$