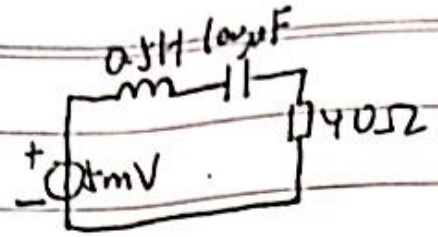
5.25.



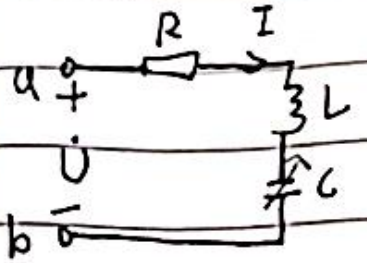
$\omega = \frac{1}{\sqrt{LC}} = 2\pi f \quad f = 22.5\text{Hz}$

$I = \frac{V}{40} = 0.125\text{mV}$

$V_C = V_L = \omega L I = \frac{I}{\omega C} = 8.84\text{mV}$

$Q = \frac{\rho}{R} = \frac{\sqrt{\frac{L}{C}}}{R} = 1.77$

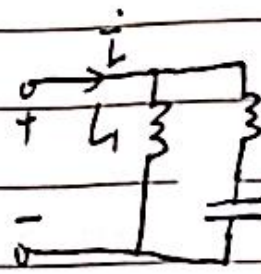
5.26 (1) $2\pi f = \frac{1}{\sqrt{LC}} \quad C = 128.69\text{pF}$



(2) $I = \frac{U}{R} = 0.15\mu\text{A}$

$V_C = \frac{I}{\omega C} = 2.29\times10^{-4}\text{V}$

5.27.



(1) $Z = (\omega L_1)j \,//\, (\omega L_2 - \frac{1}{\omega C})j$

$= \frac{j}{\frac{1}{\omega L_1} + \frac{1}{\omega L_2 - \frac{1}{\omega C}}}$

$= \frac{\omega L_1 (\omega L_2 - \frac{1}{\omega C})j}{\omega L_2 - \frac{1}{\omega C} + \omega L_1} = 0$

$\omega_0 L_2 - \frac{1}{\omega_0 C} = 0 \quad \omega_0 = \frac{1}{\sqrt{L_2 C}} = 1291 \text{ rad/s}$

(2) $Y = -\frac{1}{\omega L_1}j + (-\frac{1}{\omega L_2} // \omega C)j$

$= (-\frac{1}{\omega L_1} + \frac{1}{-\omega L_2 + \frac{1}{\omega C}})j$

$= \frac{\omega^2 C(L_1 + L_2) - 1}{\omega L_1 C(1 - \omega^2 L_2 C)} = 0 \quad \omega_p = \frac{1}{\sqrt{C(L_1+L_2)}} = 1000 \text{ rad/s}$

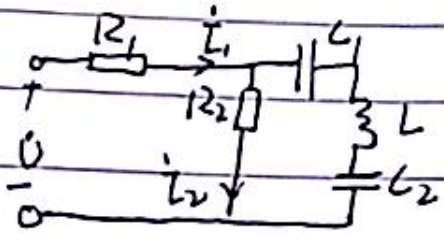
5.28. $Z = R_1 + R_2 // (-\omega C_1 + L - \omega C_2)j$

$= R_1 + |Z_2| // 0j$ 故谐振

故 C_1 L C_2 支路相对短路，故 $Z = |Z_1| = 110\Omega$

$I_1 = \frac{U}{Z} = 2A$

I_2 被短路 $I_2 = 0A$



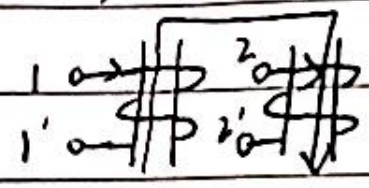
5.29. $\omega_0 = \frac{1}{\sqrt{LC}} = 10^3$ rad/s

故发生谐振

L与C支路短路，并联的灯炮被短路不亮

$U_{灯} = U = 220V > 110V$ 串联的灯炮被烧坏不亮

5.30. 对11'与22'



设电流都从1,2进入

若现2线圈磁通减弱

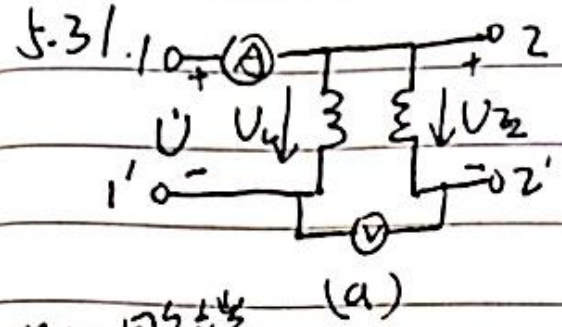
故1,2'同名端

11', 22', 33'绕法相同

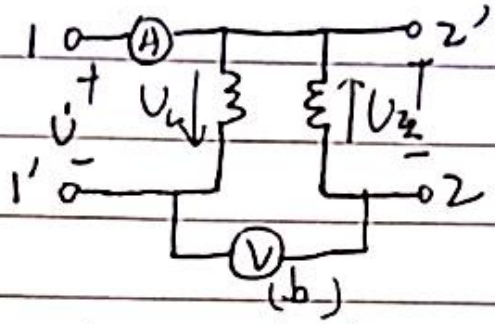
同理可有 23'同名端

13'同名端

5.31.



(a)



(b)

设12同名端

示数 $U_1 = |-\dot{U}_1 + U_2|$

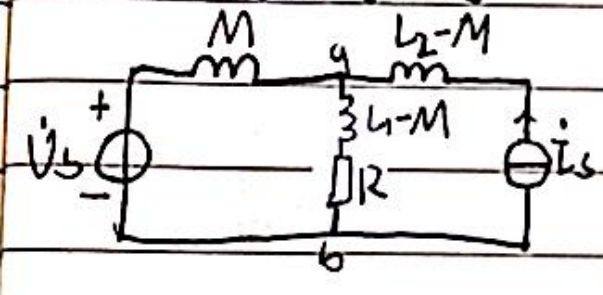
示数 $U_2 = |-\dot{U}_1 + (-U_2)|$

此时(b)示数比(a)示数为

与题干不符.

故 1,2' 同名端

5.34. 互电路等效于



由节点分析:

$$\dot{U}_{ab}\left(\frac{1}{R+j\omega(L_1-M)}+\frac{1}{j\omega M}\right)=\frac{\dot{U}_S}{j\omega M}+\dot{I}_S$$

$$\dot{U}_{ab}=12.878-3.902j$$

$$\dot{U}_{1S}=\dot{U}_{ab}-\dot{I}_S\,j(L_2-M)\omega=16.878-3.902j$$

$$\tilde{S}_{2S}=\dot{U}_{2S}\cdot\overline{\dot{I}_S}=-33.76j-7.80$$

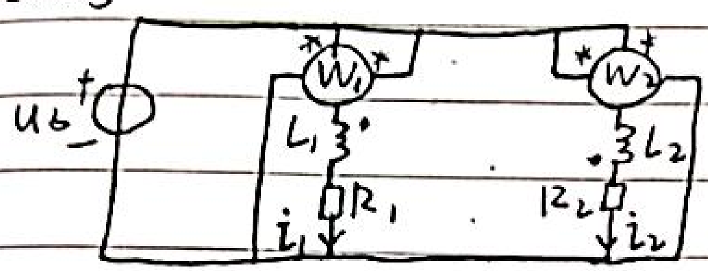
实部 $P_{2S}=7.80\,W$, 非关联负 消耗功率

$$\dot{I}_{US}=\frac{\dot{U}_{ab}-\dot{U}_S}{j\omega M}=-1.951-3.561j$$

$$\tilde{S}_{US}=\dot{U}_S\,\overline{\dot{I}_{US}}=-39.02+71.22j$$

实部 $P_{US}=-39.02\,W$, 关联负 产生功率

5.35



互感线圈并联

令 $\dot{U}_S = 100\angle 0°$

$\dot{I}_1 = \dfrac{Z_2 + Z_m}{Z_1 Z_2 - Z_m^2}\dot{U}$

$= 10.18 - 3.62j\ (A)$

$\dot{I}_2 = \dfrac{Z_1 + Z_m}{Z_1 Z_2 - Z_m^2}\dot{U}$

$= 4.90 - 6.64j\ (A)$

W_1测 L_1与R_1支路有功功率

$\tilde{S}_1 = \dot{U}_S \cdot \overline{\dot{I}_1} = 1018 - 362j$ VA

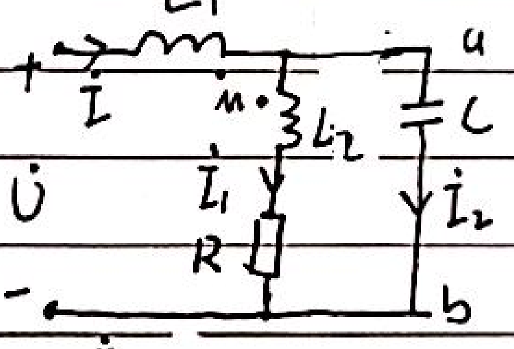
取实部 $W_1 = 1018W$

W_2测 L_2与R_2支路有功功率

$\tilde{S}_2 = \dot{U}_S \cdot \overline{\dot{I}_2} = 490 - 664j$ VA

取实部 $W_2 = 490W$

5.40.

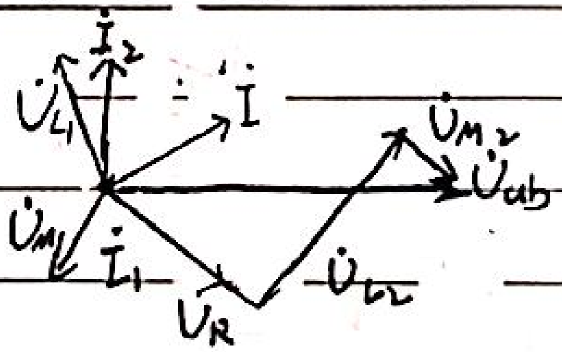


只有电阻可吸收有功功率

$I_1^2 R = P \quad R = 4.33\Omega$

以$\dot{U}_{ab}$为参考相量

由$\dot{I}_1 + \dot{I}_2 = \dot{I}$ 与 $I_1 = I_2 = I$ 构建等边三角形



由图有

$\dot{U}_{ab} = -jX_C \dot{I}_2 = 100\angle 0° (V)$

$\dot{I}_1 = 5\sqrt{3} - 5j$ A $\quad \dot{I} = 5\sqrt{3} + 5j$ A

$\dot{I}_1 R + \dot{I}_1 jX_{L_2} - \dot{I} j\omega M = \dot{U}_{ab}$

令 $R = 4.33 = 2.5\sqrt{3}$

∴

$$\text{联立}\begin{cases}\frac{25}{2}+5X_{L2}+5\omega M=100\\ -\frac{25}{2}\sqrt{3}+5\sqrt{3}X_{L2}-5\sqrt{3}\omega M=0\end{cases}\quad\begin{cases}X_{L2}=7.5\Omega\\ \omega M=5\Omega\end{cases}$$

$$\dot{U}=\dot{U}_{ab}+\dot{U}_{L1}+\dot{U}_{M1}$$
$$=100\angle 0°+\dot{I}_1 jX_{L1}-j\omega M\cdot\dot{I}_1$$
$$=(75-5X_{L1})+(5\sqrt{3}X_{L1}-25\sqrt{3})j$$

$$U=\sqrt{25X_{L1}^2-750X_{L1}+5625+75X_{L1}^2-750X_{L1}+1875}=50$$

$$100X_{L1}^2-1500X_{L1}+5000=0$$

$$X_{L1}=5\Omega \text{ 或 } 10\Omega$$

故 $R=4.33\Omega$, $\omega M=5\Omega$ $X_{L2}=7.5\Omega$

$X_{L1}=5\Omega$ 或 10Ω