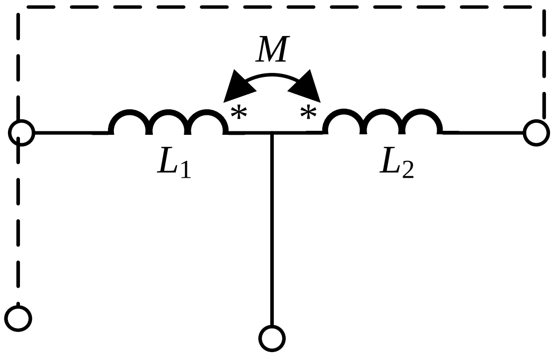
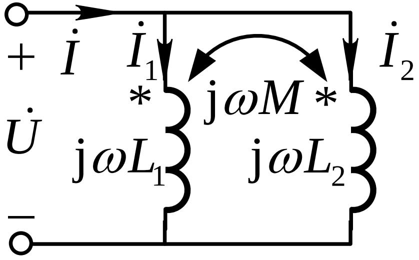
去耦等效电路

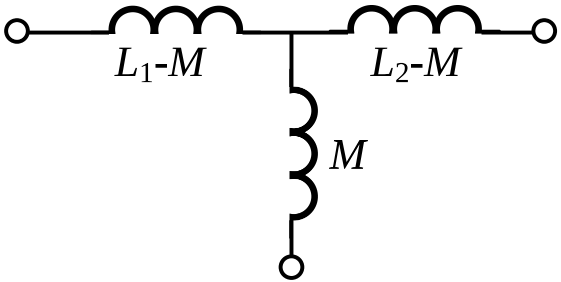
互感T型联接



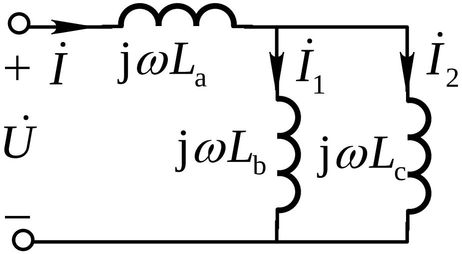
(a)



(b)



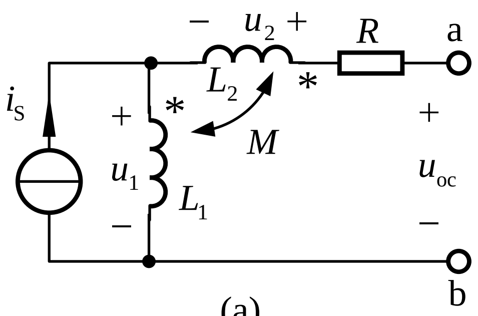
(d)



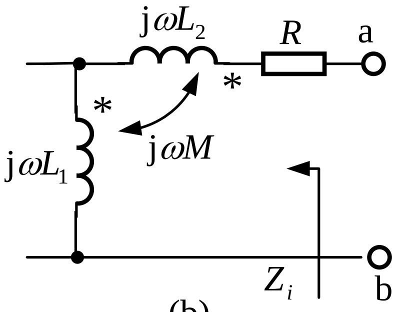
(c)

去耦等效电路

例2 已知 R=20Ω，L_1=0.1H，L_2=0.4H，耦合系数 k=0.85，$i_S = 3\sqrt{2}\cos(100t)\text{A}$。求一端口的戴维南等效电路。



(a)



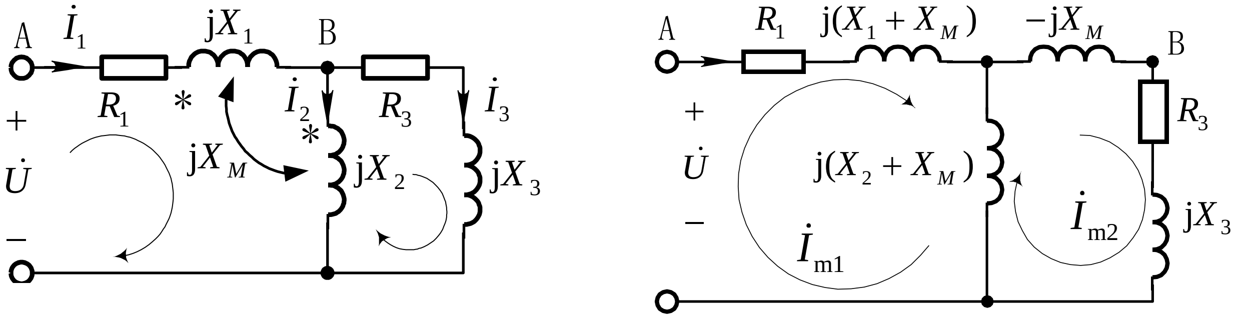
(b)

解: 计算互感 $M = k\sqrt{L_1 L_2} = 0.17\text{H}$

开路电压 $\dot{U}_{oc} = \dot{U}_2 + \dot{U}_1 = \text{j}\omega M\dot{I}_S + \text{j}\omega L_1\dot{I}_S = \text{j}81\text{V}$

等效阻抗 $Z_i = R + \text{j}\omega L_{eq} = R + \text{j}\omega(L_1 + L_2 + 2M) = (20 + \text{j}84)\Omega$

例 3 图示电路 $R_1=12\Omega,\ X_1=12\Omega,\ X_2=10\Omega,\ X_M=6\Omega,\ X_3=6\Omega$ $R_3=8\Omega, U=120\text{V}$。求电压 $\dot{U}_{AB}$。



$$\dot{U}=120\angle 0^{\circ}\,\text{V}$$

解:

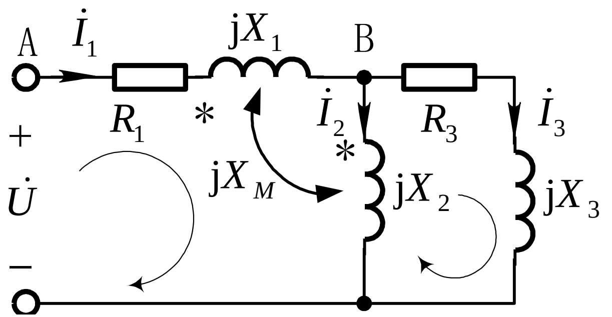
$$\begin{cases}[R_1+\mathrm{j}(X_1+X_M)+\mathrm{j}(X_2+X_M)]\dot{I}_{m1}-\mathrm{j}(X_2+X_M)\dot{I}_{m2}=\dot{U} & (1)\\ -\mathrm{j}(X_2+X_M)\dot{I}_{m1}+[-\mathrm{j}X_M+R_3+\mathrm{j}X_3+\mathrm{j}(X_2+X_M)]=0 & (2)\end{cases}$$

得

$$\dot{I}_{m1}=4.27\angle-49.04^{\circ}\,\text{A};\ \dot{I}_{m2}=3.82\angle-22.47^{\circ}\,\text{A}$$

$$\dot{U}_{AB}=[R_1+\mathrm{j}(X_1+X_M)]\dot{I}_{m1}+(-\mathrm{j}X_M)\dot{I}_{m2}\ =83.63\angle-6.58^{\circ}\,\text{V}$$

例3 图示电路 $R_1=12\Omega,\ X_1=12\Omega,\ X_2=10\Omega,\ X_M=6\Omega,\ X_3=6\Omega$ $R_3=8\Omega, U=120\text{V}$。求电压 $\dot{U}_{AB}$。



列支路电流方程

$$\dot{U}=120\angle 0^{\circ}\,\text{V}$$

$$\begin{cases}\dot{I}_1=\dot{I}_2+\dot{I}_3\\ \dot{U}=R_1\dot{I}_1+\mathrm{j}X_1\dot{I}_1+\mathrm{j}X_M\dot{I}_2+\mathrm{j}X_M\dot{I}_1+\mathrm{j}X_2\dot{I}_2\\ \mathrm{j}X_M\dot{I}_1+\mathrm{j}X_2\dot{I}_2=(R_3+\mathrm{j}X_3)\dot{I}_3\end{cases}$$

$$\dot{I}_1=4.27\angle -49.04^{\circ}\,\text{A}$$

$$\dot{I}_2=1.9117\angle -122.475^{\circ}\,\text{A}$$

$$\dot{U}_{AB}=R_1\dot{I}_1+\mathrm{j}X_1\dot{I}_1+\mathrm{j}X_M\dot{I}_2$$

$$=83.63\angle -6.58^{\circ}\,\text{V}$$