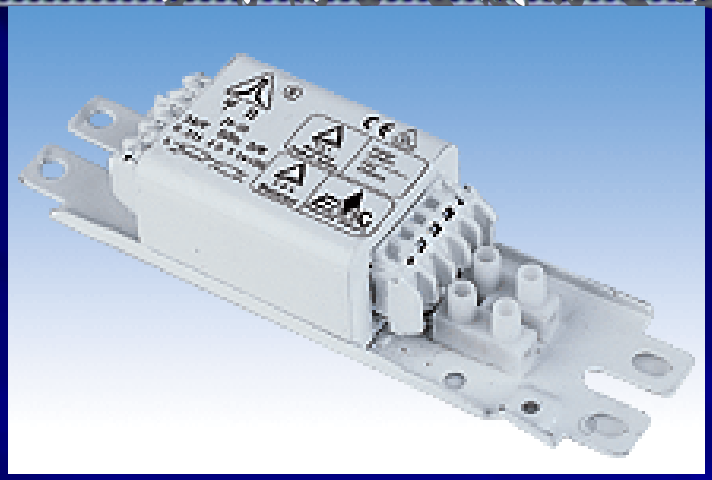
第6章 理想变压器

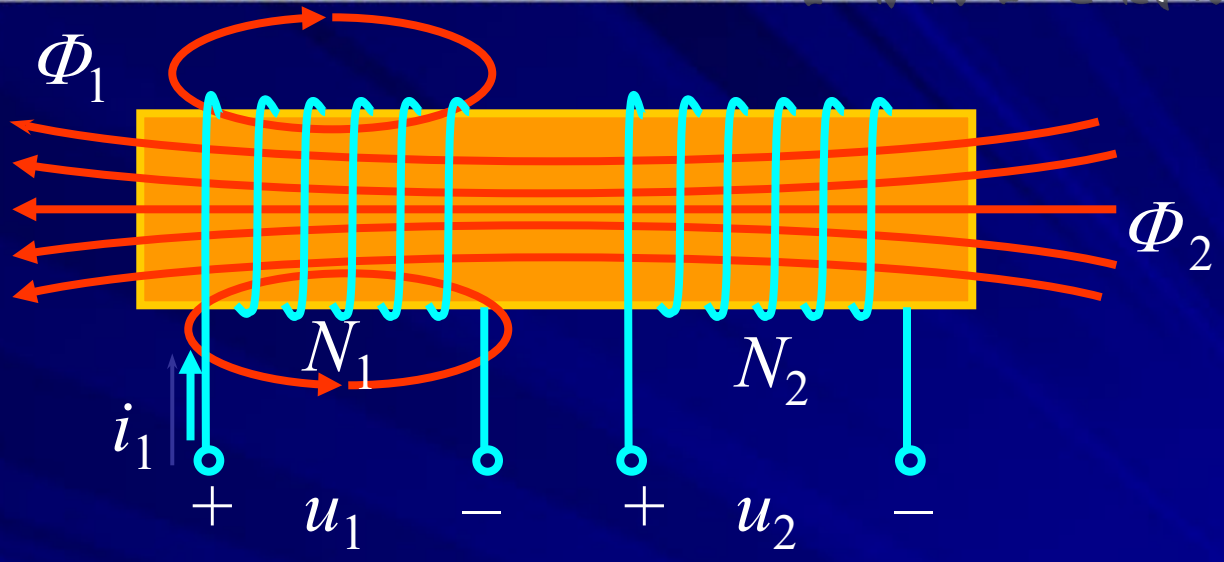
调压器



整流器

牵引电磁铁

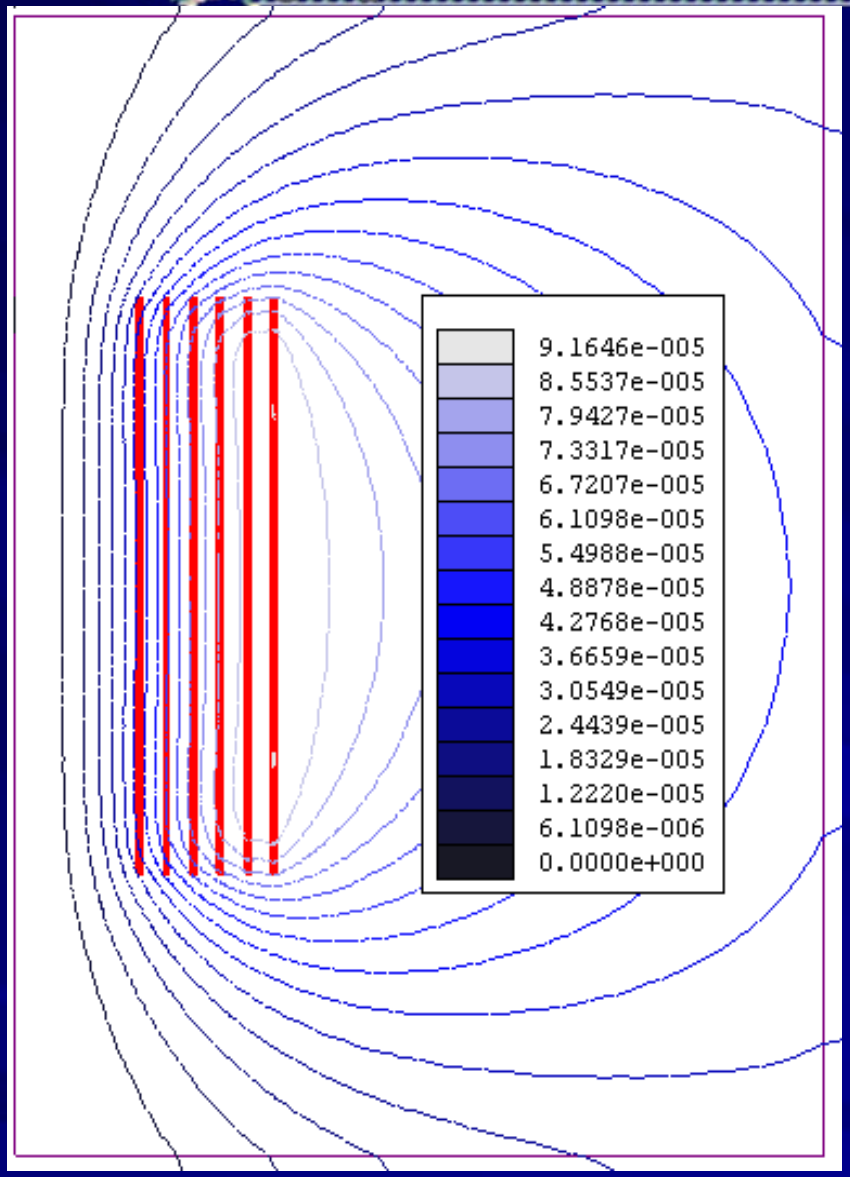
电流互感器



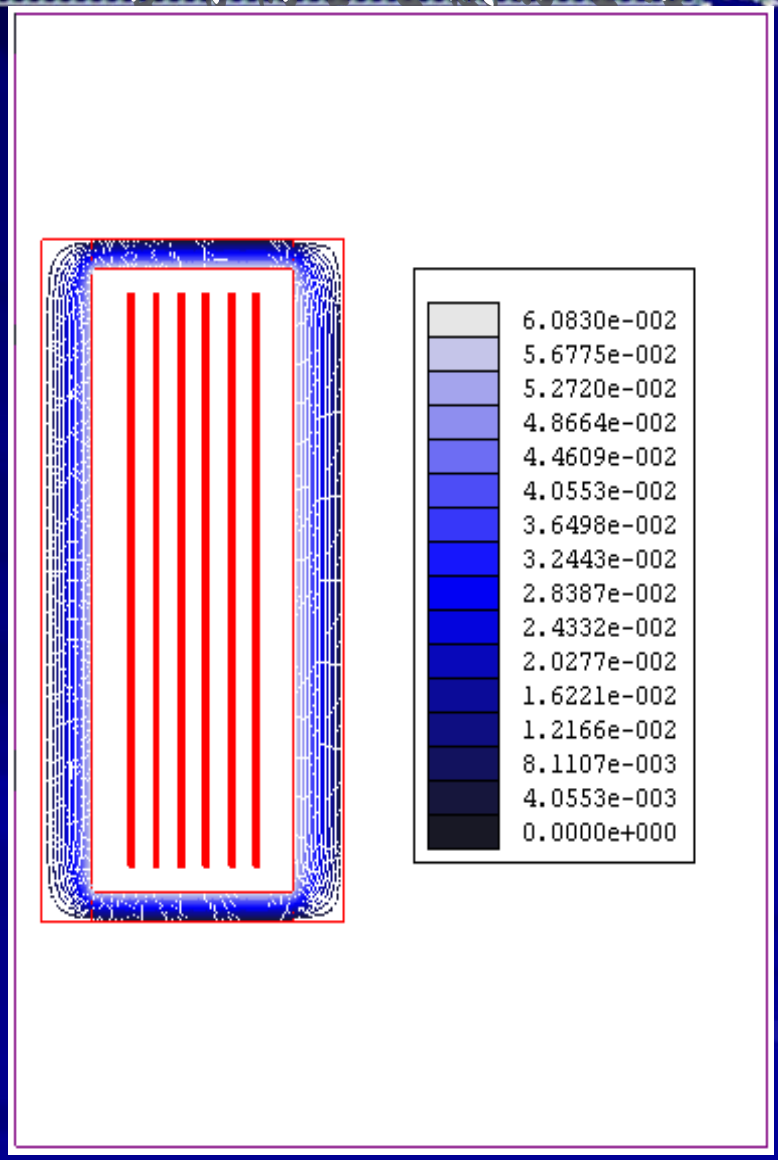
当i_1为时变电流时，磁通也将随时间变化，从而在线圈两端产生感应电压。

当i_1、u_1、u_2方向与Φ 符合右手螺旋时，根据电磁感应定律和楞次定律：

$$u_1 = \frac{\mathrm{d}\Psi_1}{\mathrm{d}t} \qquad u_2 = \frac{\mathrm{d}\Psi_2}{\mathrm{d}t}$$



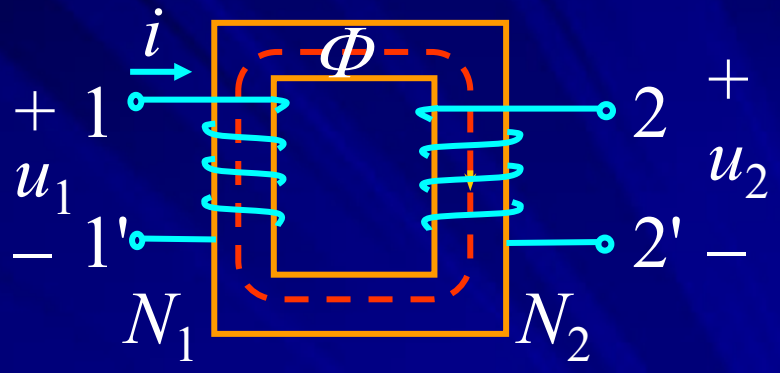
电抗器磁场



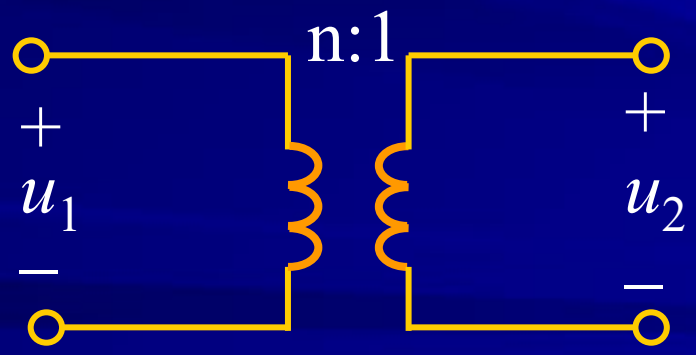
铁磁材料屏蔽磁场

理想变压器的主要性能

①变压关系

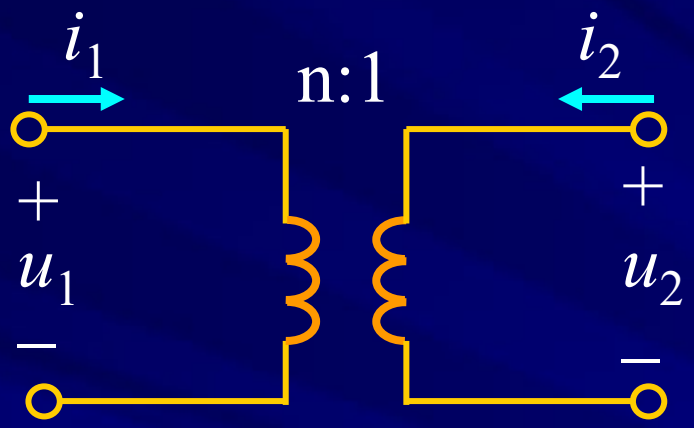


$$u_1 = \frac{d\psi_1}{dt} = N_1 \frac{d\phi}{dt} \qquad u_2 = \frac{d\psi_2}{dt} = N_2 \frac{d\phi}{dt}$$



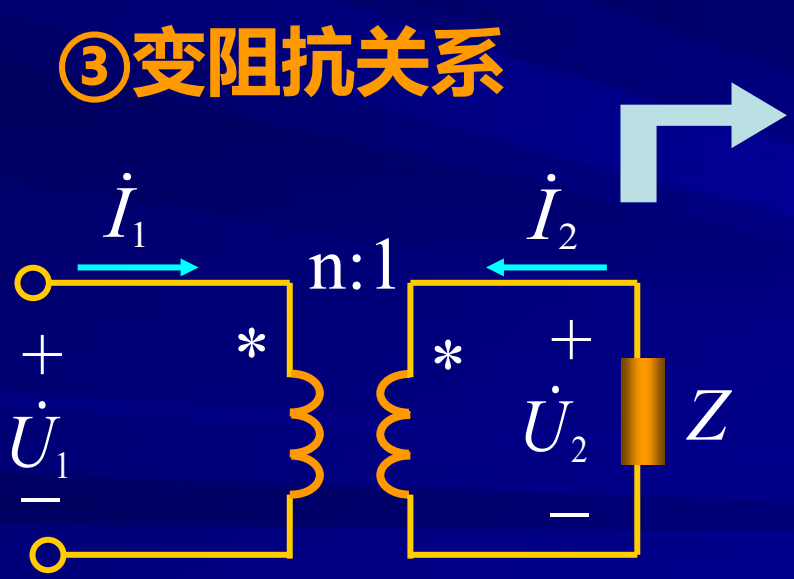
$$\frac{u_1}{u_2} = \frac{N_1}{N_2} = n$$

②变流关系



$$i_1(t) = -\frac{1}{n} i_2(t)$$

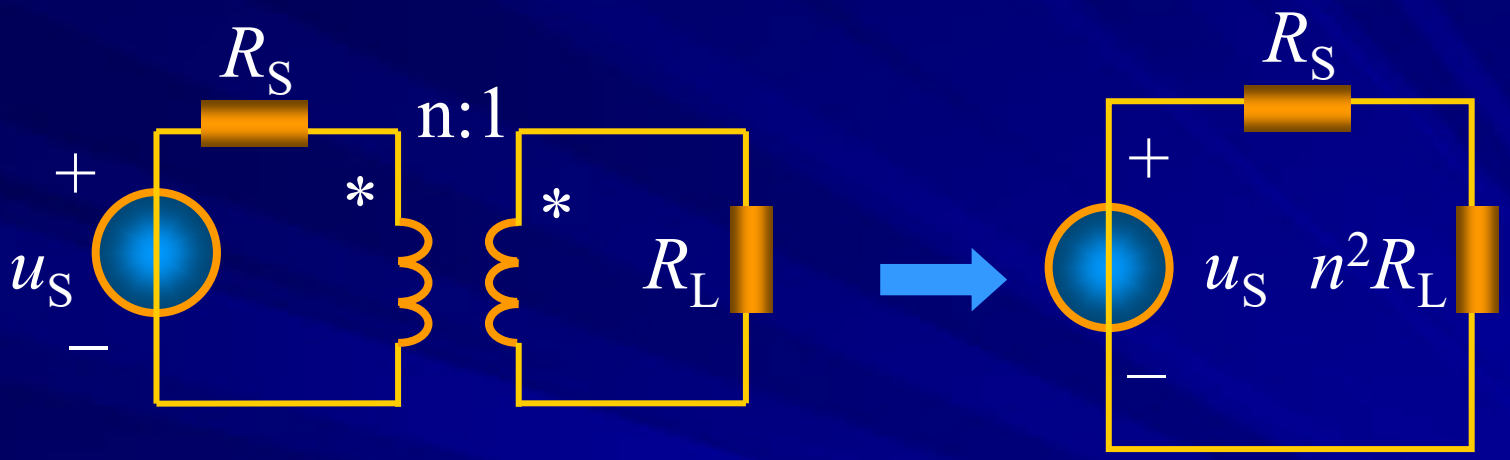
③变阻抗关系



$$\frac{\dot{U}_1}{\dot{I}_1} = \frac{n\dot{U}_2}{-1/n\dot{I}_2}$$

$$= n^2\left(-\frac{\dot{U}_2}{\dot{I}_2}\right) = n^2 Z$$

例1　已知电源内阻R_S=1kΩ，负载电阻R_L=10Ω。为使R_L获得最大功率，求理想变压器的变比n。

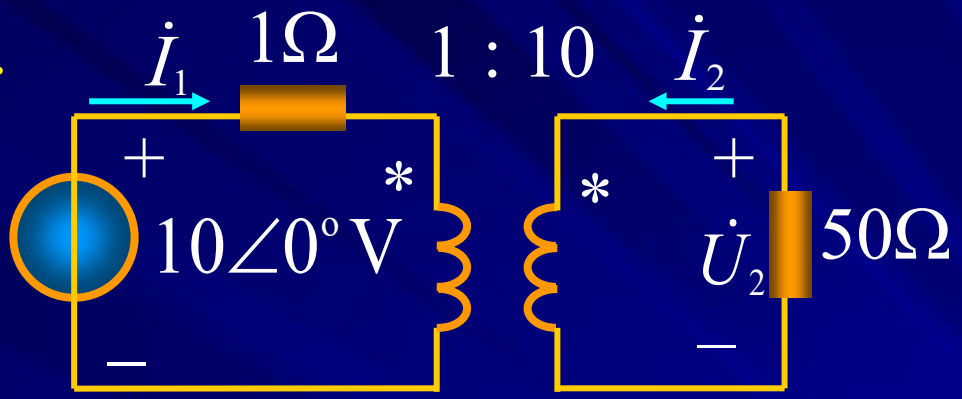


解　应用变阻抗性质

当　$n^2R_L=R_S$ 时匹配，即　$10n^2=1000$

$\therefore\ n^2=100$，　$n=10$.

例2　求电压 $\dot{U}_2$.

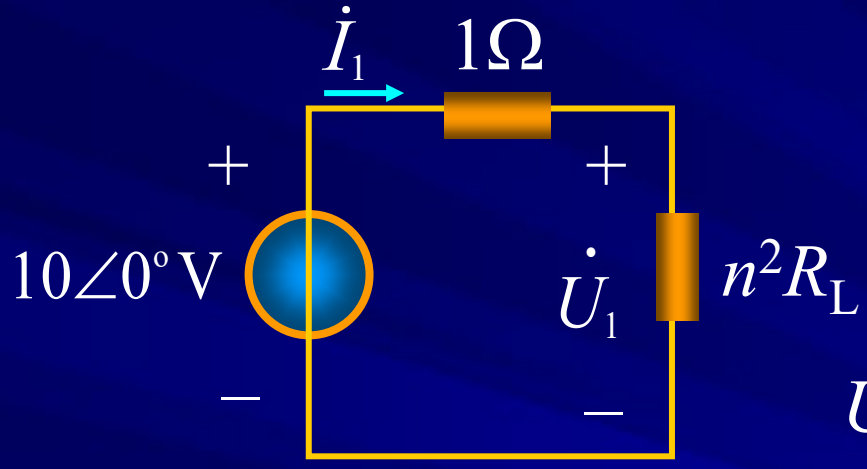


解　**方法1：列方程**

$$\begin{cases} 1\times \dot{I}_1+\dot{U}_1=10\angle 0^\circ \\ 50\dot{I}_2+\dot{U}_2=0 \\ \dot{U}_1=\dfrac{1}{10}\dot{U}_2 \\ \dot{I}_1=-10\dot{I}_2 \end{cases}$$

解得 ⟹ $\dot{U}_2=33.33\angle 0^\circ$ V

方法2：阻抗变换



$$n^2R_L=(\frac{1}{10})^2\times 50=\frac{1}{2}\Omega$$

$$\dot{U}_1=\frac{10\angle 0^\circ}{1+1/2}\times\frac{1}{2}=\frac{10}{3}\angle 0^\circ\text{V}$$

$$\dot{U}_2=\frac{1}{n}\dot{U}_1=10\dot{U}_1=33.33\angle 0^\circ\text{V}$$