阻抗
Impedance

电感产生感抗，电容产生容抗，

二者总称为电抗，纯电阻R。

Inductive impedance in an electric inductance is $X_L = j\omega L$, and condenser impedance in a condenser is

$$X_L = j\omega L$$

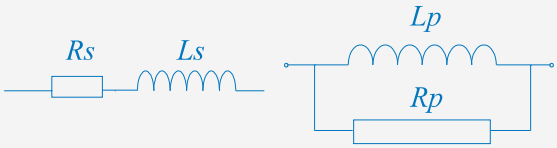
$$Xc = \frac{1}{j\omega C}$$

三者总称阻抗，在磁性器件讨论中，相对低的频率下，我们忽略容抗，只讨论电阻和感抗，且有串联电路和并联电路之分。

Zs、Zp都与频率有关，其特性称为阻抗频率特性，它与磁性材料频率特性有关。另外，它们与绕组参数有关。在复数磁导率中，其频率特性表现为μ'，μ"的频率特性。阻抗频率特性，实际上是磁性器件的特性，并非是材料的特性。

These two are generally called electrical impedance. Adding pure resistance R, they are in all called impedance. In magnetic devices, we only consider inductive impedance and pure resistance for the issue of relative low frequency, neglecting condenser impedance. There is the difference between serial and parallel circuit.

Zs and Zp depend on frequency, and their characteristics are called impedance frequency characteristics and related to the frequency characteristics of magnetic materials, and they are connected with winding parameters. In complex permeability, its frequency characteristics is determined by the frequency characteristics of both μ' and μ". Actually, the impedance frequency characteristic is the characteristic of the magnetic device but the characteristic of material.



串联电路
Series representation

并联电路
Parallel reparesentation

$$Z_S = R_S + j\omega L_S$$

串联电路中阻抗
Series representation

$$Z_p = \frac{1}{1/(j\omega L_p) + 1/R_p}$$

并联电路中阻抗
Parallel reparesentation

损耗因子
Loss factor

tgδm表示小信号下材料的损耗特性。由于磁芯损耗，引起信号相移，其表示为：

称为损耗因子，表示的是损耗功率与贮能的比值。因磁芯损耗包括磁滞损耗，涡流损耗、剩余损耗，所以损耗因子可表示为:

tgδm= tgδh + tgδe + tgδr，分别称为磁滞、涡流、剩余损耗因子。

Loss factor indicates the loss property of material in small signal. It induces phase shift of signal due to magnetic core loss, which can be expressed as:

where tgδm is called loss factor indicating the ratio of loss power and input power. Because magnetic core loss induces hysteresis loss, eddy loss, and residual loss, the loss factor can be expressed as:

tgδm= tgδh + tgδe + tgδr , Where tgδh, tgδe, and tgδr is called hysteresis loss factor, eddy loss factor, and residual loss factor respectively (see the following Figure).

$$tg\delta_m = \frac{R_s}{\omega L_s} = \frac{\mu''_s}{\mu'_s}$$

或
or

$$tg\delta_m = \frac{\omega L_p}{R_p} = \frac{\mu'_p}{\mu''_p}$$