4 电路基本理论.

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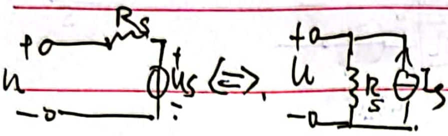
u.i.R.C.L.p. G(s).

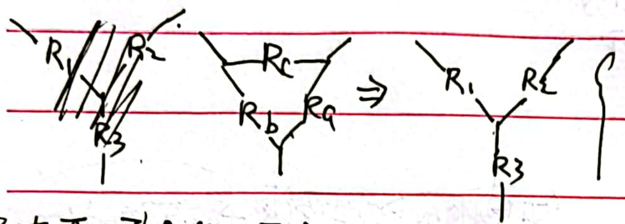
$p=ui$. $W=\int p\,dt$

$u=\frac{1}{C}\int i\,dt$. $W=\frac{1}{2}Cu^2$

$u=L\frac{\partial i}{\partial t}$. $W=\frac{1}{2}Li^2$



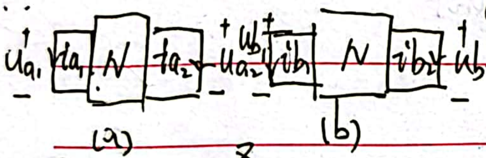
$u_S=I_SR$. ⟺ ∀线性电路. $U_S=U_{oc}$, $I_S=I_{SC}$, $R_S=R_{eq}=\frac{U_{oc}}{I_{SC}}$



$R_1=\frac{R_bR_c}{\sum R}$, $R_2=\frac{R_aR_c}{\sum R}$, $R_3=\frac{R_aR_b}{\sum R}$. $R_Y=R_\Delta/3$.

置换Thf. 线性Thf.

(特勒根) 互易Thf (参考3.18, 3.19). U和I或线性响应但R不是!!!



a: u_{a_1} i_{a_1} u_{b_1} i_{b_1}; b: u_{a_2} i_{a_2} u_{b_2} i_{b_2}

$u_{a_1}i_{a_2}+u_{b_1}i_{b_2}=u_{a_2}i_{a_1}+u_{b_2}i_{b_1}$

正弦: $Z=\frac{Z}{\sqrt{2}}$. $A_m\cos(\omega t+\varphi)\Rightarrow\frac{A_m}{\sqrt{2}}\angle\varphi=\frac{A_m}{\sqrt{2}}\cos\varphi+\left(\frac{A_m}{\sqrt{2}}\sin\varphi\right)i$

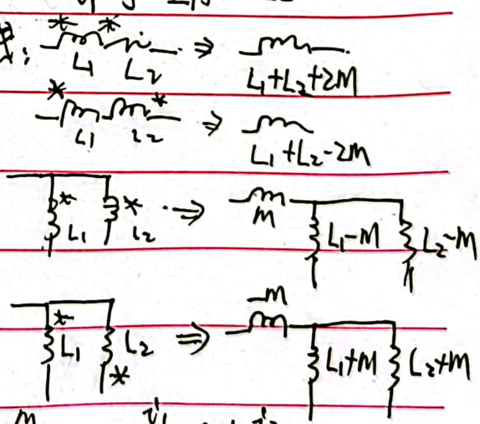
$R\to R$. 相位差: $\varphi_a-\varphi_b$.

$C\to\frac{1}{j\omega C}$

$L\to j\omega L$.

$U_1=j\omega L_1I_1+j\omega MI_2$

互感:



功率: $|P|=\dot{U}\cdot\dot{I}=|U||I|\cos\angle\varphi$.

(参考4.22) if ($I_mU=0$ or $I_mI=0$),

$|P|=R_eU\cdot R_eI$

$\angle\varphi\in(-\frac{\pi}{2},\frac{\pi}{2})$. $p>0$.

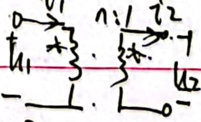
$\angle\varphi$ else $p<0$

S, Q, P, φ

最大功率: ①共轭 ②模相等

$P_{\max}=\frac{U_S^2}{4R_S}$ $U_S=|U_S|$ $R_S=R_e[R_S]$.

$k=\frac{M}{\sqrt{L_1L_2}}$



$u_2=\frac{1}{n}u_1$ $H_u=\frac{1}{n}$

$i_2=n i_1$ $H_i=n$.

$n^2Z\leftarrow Z$ 异名端加负号.

$P_L=|U_L||I_L|\cos\varphi$. $\omega=\frac{1}{\sqrt{LC}}$ 谐振

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电路基本理论

暂态：$f(t)=f_p(t)+[f(0^+)-f_p(0^+)]e^{-t/\tau}$

截止：$H(\omega)=\frac{H_0}{\sqrt{2}}$

$\tau = RC = L/R$

$K \to A$

$Kt \to At+B$

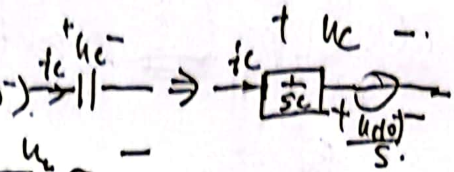
$Kt^2 \to At^2+Bt+C$

$b \neq 1/\tau$: $Ke^{-bt} \to Ae^{-bt}$

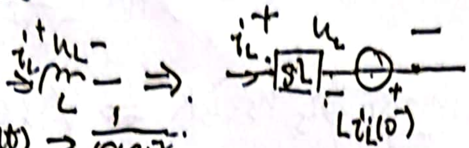
$b = 1/\tau$: $Ke^{-bt} \to Ate^{-bt}$

$\cos(\omega t+\varphi) \to \cos(\omega t+\varphi)$

Laplace: C → $U_c = \frac{1}{sC}I_c + \frac{u_c(0^-)}{s}$, $I_c = sCU_c - Cu_c(0^-)$



L → $U_L = sLI_L - Li_L(0^-)$



$e^{-at}u(t) \to \frac{1}{s+a}$　　$te^{-at}u(t) \to \frac{1}{(s+a)^2}$

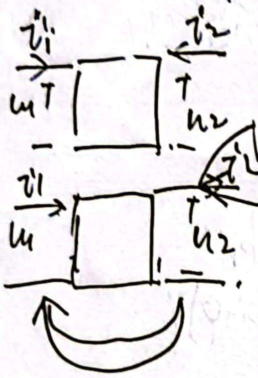
$\cos\omega_0 t\, u(t) \to \frac{s}{s^2+\omega_0^2}$　　$t\,u(t) \to \frac{1}{s^2}$

$\sin\omega_0 t\, u(t) \to \frac{\omega_0}{s^2+\omega_0^2}$

$\delta(t) \to 1$

$u(t) \to \frac{1}{s}$

Y ← 纯电阻不含受控源 → 矩阵对称，互易



阻抗参数矩阵：$\begin{bmatrix} \cdot & \cdot \\ \cdot & \cdot \end{bmatrix}\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$

i_2 反向！

传输：$\begin{bmatrix} A \end{bmatrix}\begin{bmatrix} u_2 \\ -i_2 \end{bmatrix} = \begin{bmatrix} u_1 \\ i_1 \end{bmatrix}$ 负数!!!

互易：$A_{11}A_{22}-A_{12}A_{21}=1$