

期中复习

$$\Psi = BA \xrightarrow{B = \mu H} \Psi = \mu H A \xrightarrow{\mu = \mu_0 \mu_r} \Psi = \mu_0 \mu_r H A$$

$$R_m = \frac{U_m}{\Psi} \quad R_m = \frac{U_m}{\Psi} = \frac{H \cdot l}{B \cdot A_m} = \frac{l}{\mu A_m}$$

$$\boxed{\frac{l}{\mu A_m}}$$

$$1. B \xrightarrow{B = \mu H} H \xrightarrow{F = \Phi H dL} F = NI = \Psi R_m = Hl.$$

$$U_m = R_m \Psi = \int H dL.$$

2. 恒定磁通通过 R_m 不消耗能量 ($f_{会}, f_{↑},$ 耗能) 铁心损耗 $\propto f^{1.7/1.8}$, 与 B/U 也有关.

3. 自感 $L =$ 一个线圈通过单位电流形成的磁链

$$L = \frac{\Psi}{I} = \frac{N\Psi}{I} = \frac{N\Lambda F}{I} = \frac{N\Lambda NI}{I} = N^2 \Lambda.$$

$$\begin{aligned} \text{互感 } M &= \\ M_{21} &= \frac{\Psi_{21}}{I_1} = \frac{N_2 \Psi_{21}}{I_1} = \frac{N_2 \Lambda_{12} F_{21}}{I_1} = \frac{N_2 \Lambda_{12} N_1 I_1}{I_1} = N_1 N_2 \Lambda_1. \\ M_{12} &= N_1 N_2 \Lambda_{12} = M_{21}. \end{aligned}$$

4. 为什么要使用薄硅钢片叠成铁心.

① 薄硅钢片磁导率高, 磁阻小

② 增大漏流回路的电阻以减小漏流损耗.

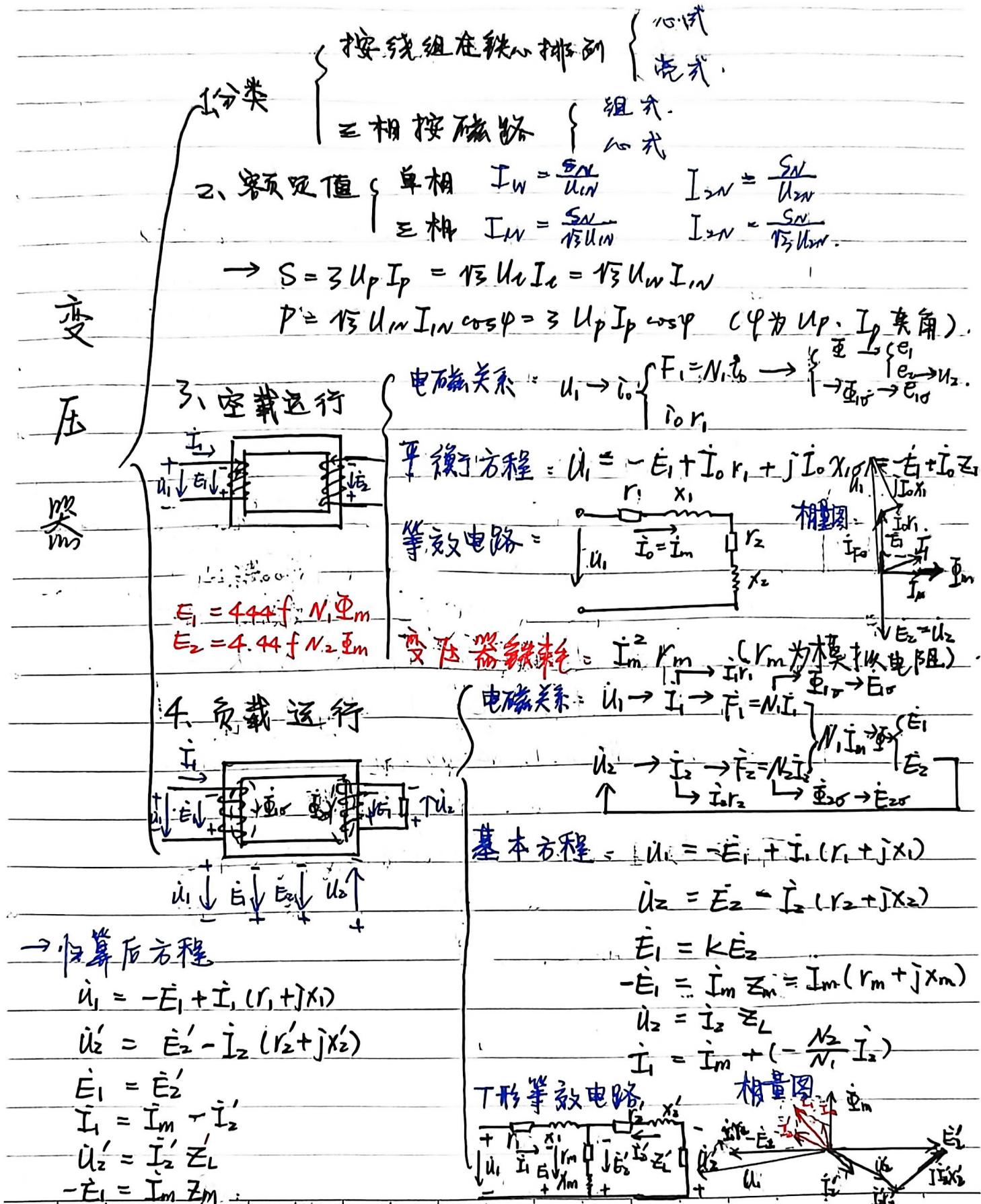
绪

论

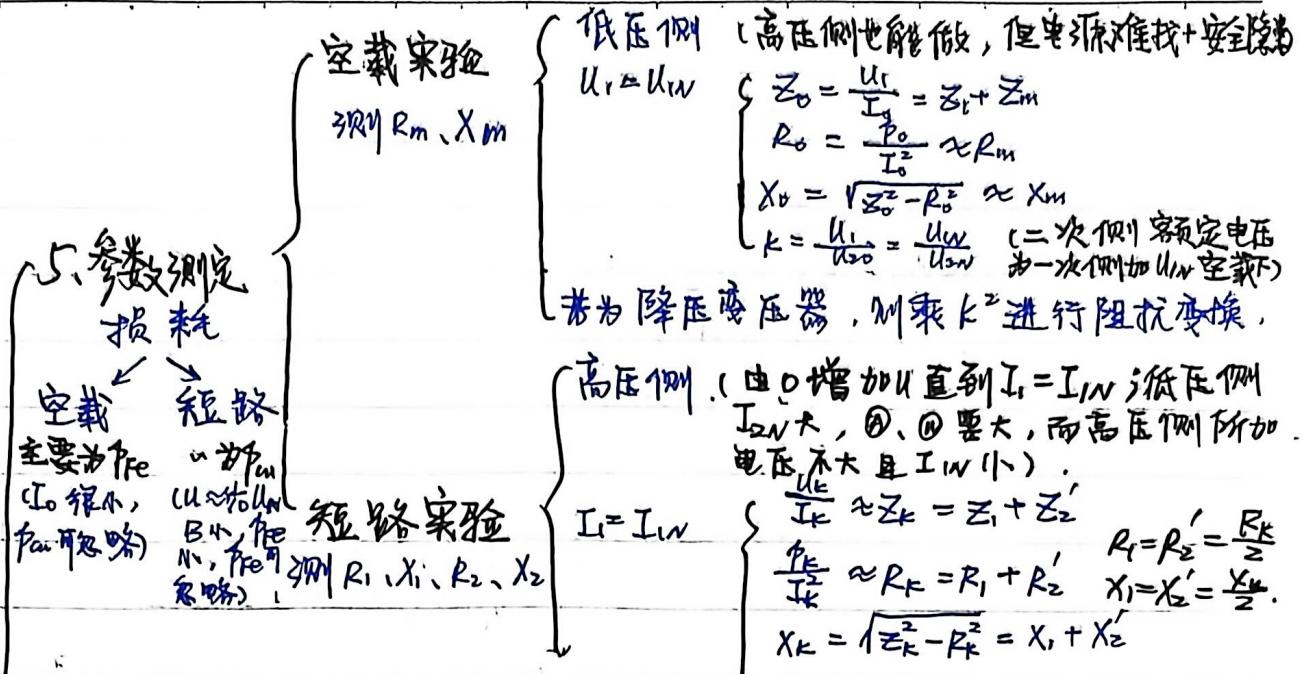
变

压

磁



上接



⇒ 温度折算: 针对电阻, X_m 无需折算

6. 短路电压
阻抗电压
电压调整率
效率

$$I_1 = I_{IN}, U_E \text{ 为短路电压}$$

$$U_{KN} = I_{IN} Z_K \Rightarrow U_{K*} = \frac{U_E}{U_{IN}} = Z_{K*}$$

$$U_{K*} = \frac{U_{E*}}{U_{IN}} = \frac{I_{IN} R_K}{U_{IN}} = R_{K*}$$

$$U_{K*} = X_{K*}$$

$$\Delta U = \frac{U_{20} - U_{2*}}{U_{20}} \times 100\% = \frac{U_{2N} - U_{2*}}{U_{2N}} \times 100\% = (1 - U_{2*}) \times 100\%$$

$$= (U_{K*} \cos \varphi_2 + U_{K*} \sin \varphi_2) \times 100\%$$

$$\beta = \frac{I_2}{I_{2N}} = I_{2*} = \frac{I_2/k}{I_{2N}/k} = \frac{I_2}{I_{2N}}$$

$$\eta = \left(1 - \frac{\beta^2 P_{KN} + P_0}{\beta^2 S_{IN} \cos \varphi_2 + \beta^2 P_{KN} + P_0} \right) \times 100\%$$

7. 变压器联结组 (分针: 高压绕组线电势 E_{AB})

附针 = 低 ~ 线 ~ E_{ab} .

Yy { 组式 \times (已失项波 = 幅值增大十进制)

8. 绕组 { Yn ✓

Yd 大变匝端 I_2 

9. 容量分配: $S_1 : S_2 : \dots = \frac{S_{IN}}{Z_{1*}} = \frac{S_{IN}}{Z_{2*}} = \dots$

三线组: 升压变: 高-低-中(A) 降压变: 高-中-低

TA: 副方不能开路 (原本 I_m 小, 一开路, 全用于励磁, I_m 增大)

TV: 副方不能短路 (I_m 外加 U_{IN} , I_K 增大)

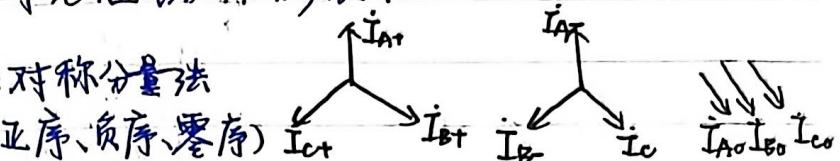
② 突然开路
高电压

上接

1 TA = 不允许加 Fuse, 可短路
检修时先短路再修表.

11. 三相变压器的对称分量法

不对称运行 (正序、负序、零序)



1. 基本术语:

每极每相槽数 $q = \frac{Z}{2pm}$ 槽距角 $\alpha = \frac{\pi \times 360}{Z}$ 极距 $r = \frac{Z}{2p}$ 节距(跨距) y 每相串联匝数 $N = \frac{2p \cdot q \cdot Ny}{\alpha}$ 整距绕组: $E_y(y=z) = 4.44fNy\Phi_1$ 短距 $w = E_y(y < z) = 4.44fNy k_{y1} \Phi_1$ 线圈组: $E_{y1}(y < z) = 4.44fNy k_{y1} q \Phi_1$ 相绕组: $E_{\Phi1} = 4.44fNk_{w1} \Phi_1$

2. 三相定子转子的

电动势

谐波

相电动势: $E_{sy} = 4.44f_N k_{w1} \Phi_1$ $k_{w1} = \sin(\frac{\pi}{2} \times 90^\circ) \times \frac{\sin \frac{q\alpha}{2}}{q \sin \frac{\alpha}{2}}$

3. 减小谐波电势

使励磁磁场接近正弦分布

短距、分布绕组

采用Y连接

4. 单相绕组磁势
(脉振磁势).

可分解为幅值均为
原 $\frac{1}{2}$ 的两个旋转磁势
转速同, 转向反.

整距绕组: $f_y(x, t) = 0.9 Ny [\sin x + \frac{1}{3} \sin 3x + \dots] \sin \omega t$ → 基波分量 $f_{y1}(x, t) = 0.9 Ny \sin x \sin \omega t$
幅值 $F_{y1} = 0.9 Ny I$ 线圈组: $F_{q1} = 9 F_{y1} k_{q1} = 0.9 Ny I q k_{q1}$ 短距绕组: $F_{y1} = 2 F_{q1} k_{y1}$ 相绕组: $F_{\Phi1} = 0.9 \frac{Nk_{w1}}{p} I$ (基波) $\rightarrow k_{w1} = k_{y1} k_{q1} = \sin(\frac{\pi}{2} \times 90^\circ) \times \frac{\sin \frac{q\alpha}{2}}{q \sin \frac{\alpha}{2}}$ → 谐波: $F_{\Phi2} = 0.9 \frac{1}{2} \frac{Nk_{w2}}{p} I$

上接

$$5. \text{三相绕组磁势} \left\{ \begin{array}{l} \text{幅值 } F_1 = \frac{3}{2} \times 0.9 \times \frac{N k_{w1}}{P} I \\ \text{某相 } I_p \max, \text{ 旋转磁势幅值转到该相绕组轴线上} \end{array} \right.$$

$$\rightarrow \text{谐波磁势} \left\{ \begin{array}{l} F_{pV} = 0.9 \frac{1}{2} \frac{N k_{wV}}{P} I \\ n_{0V} = \frac{n_0}{2} \end{array} \right.$$

$$\left. \begin{array}{l} k=0, v=-1 \\ v=6k-1 \text{ (反相)} \quad k=0, v=1 \\ v=6k+1 \text{ (同相)} \end{array} \right.$$

$$6. \text{不对称三相电流} \left\{ \begin{array}{l} F_+ = F_- = \text{脉振磁势} \\ F_+ / F_- = 0 : \text{圆形} \\ F_+ \neq F_- = \text{椭圆形} \end{array} \right.$$

$$1. \text{额定定值: } P_n = \text{输出的机械功率.}$$

$$U_n / I_n = \text{定子绕组线电压/线电流.}$$

异步电机
4.2

$$2. \text{异步电动机} = \left\{ \begin{array}{l} 0 < n < n_0 \\ 0 < s < 1 \end{array} \right. \quad \Delta n = n_0 - n.$$

$$S = \frac{n_0 - n}{n_0}$$

$$\sim \text{发电机} = \left\{ \begin{array}{l} n > n_0 \\ S < 0 \end{array} \right.$$

$$\text{电磁制动} = \left\{ \begin{array}{l} n < 0 \\ S > 1 \end{array} \right.$$

3. 主磁通 = 与定转子绕组交链

漏 ~ = 不属于主磁通的磁通.