

chapter 7: trans, generator, and bus protection:



{ unit protection no coordination
 differential protection

{ distance
 overcurrent
 fuse

⇒ { coordination in
 each level

two-level
⇒ coordination

{ 400 kV
 230 kV
 63 kV
 20 kV

⇒ levels

advanced
protection

includes trans
distance protection

1) generator protection:

extra protection

{ negative sequence (10% positive sequence)
 under voltage (0.05^{pu})
 over voltage (0.05^{pu})
 under frequency (0.2^{Hz})
 over frequency (0.2^{Hz})
 over flux ($\propto \frac{V}{f}$)
 under flux ($\propto \frac{V}{f}$)
 pole slip

Protection

1) stator

phase to phase

the s.c of 1 phase winding (a part of)

phase to ground

2) rotor

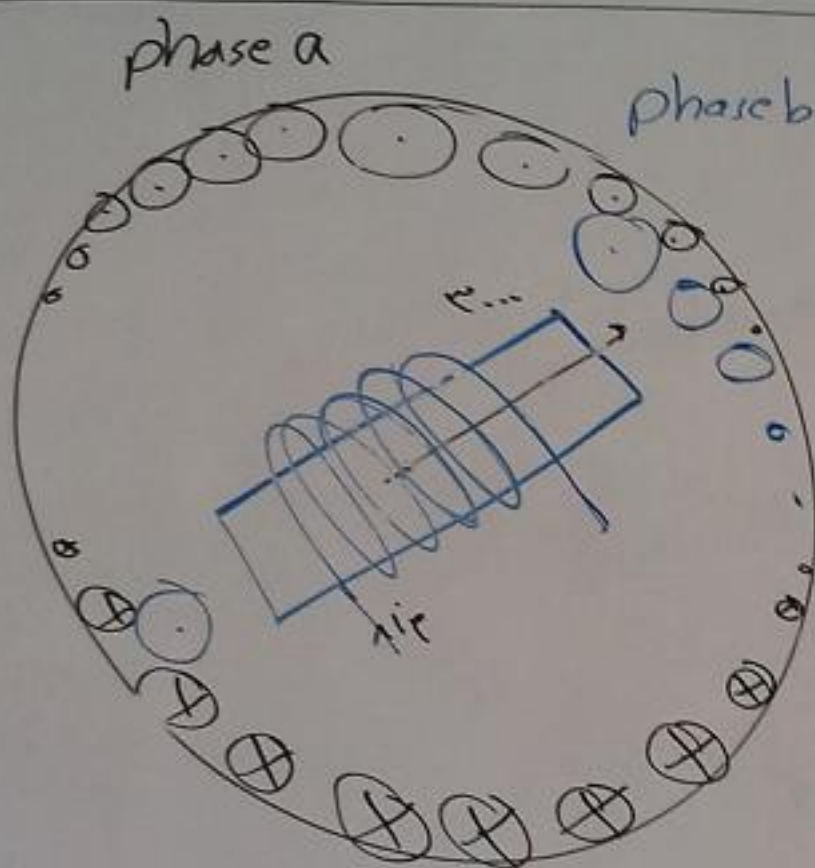
phase to ground

the loss of excitation (A)

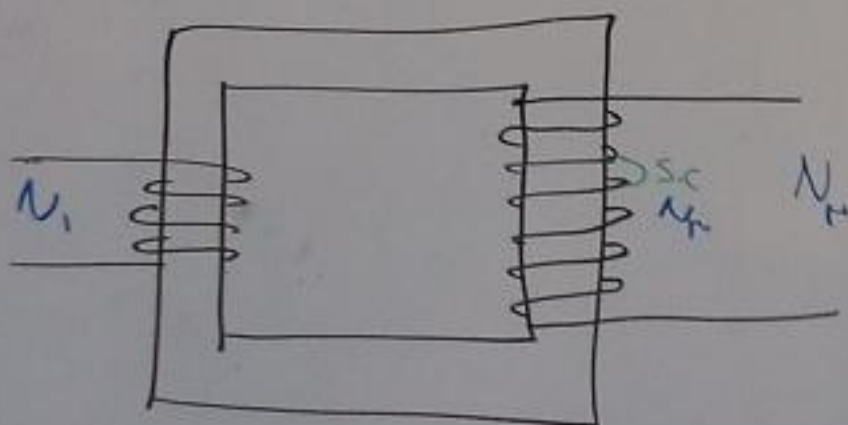
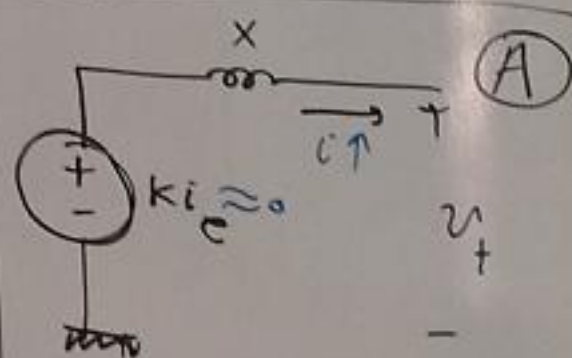
3) unexpected load

balance load

unbalance load



winding in
sync. machine



N_1 : primary winding

N_2 : secondary winding

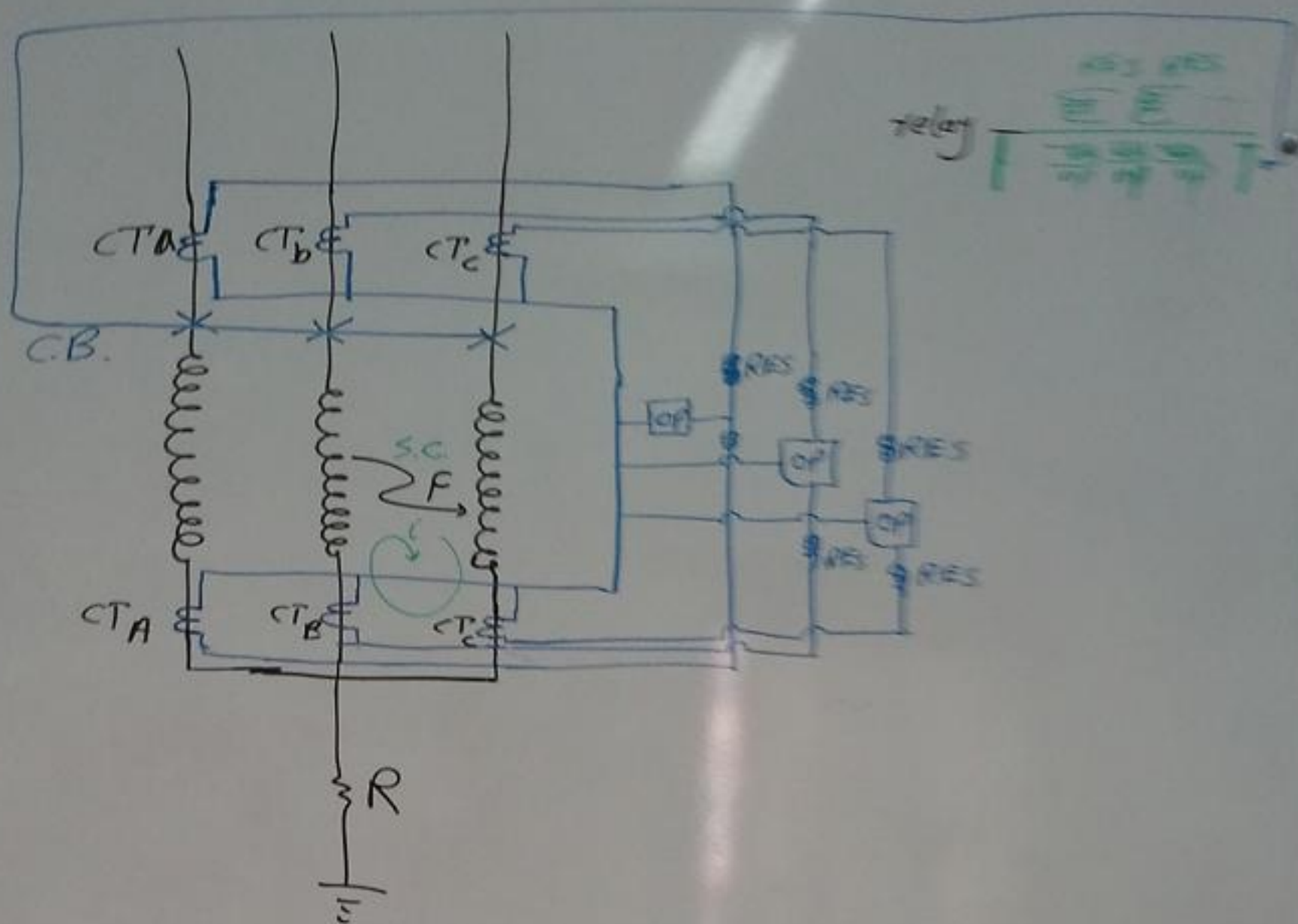
N_w { the number of
secondary winding that
is shorted

main problem \Rightarrow

high current in shorted winding

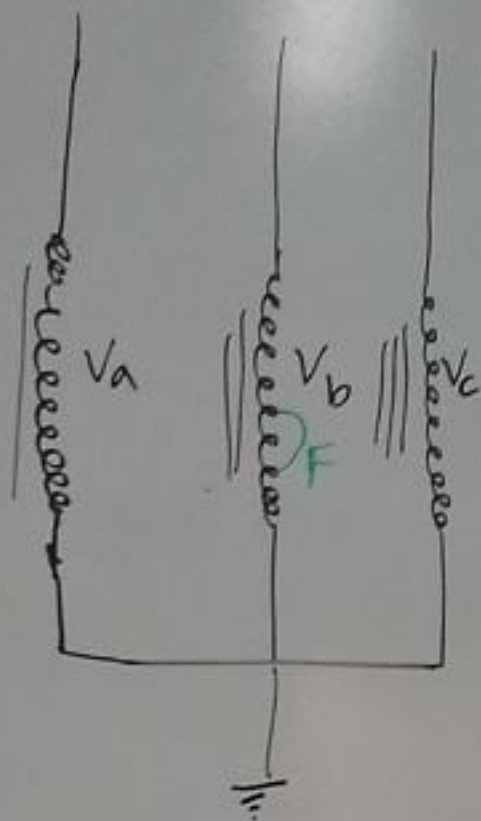
$N_2 \rightarrow N_2 - N_w$
no important, if
 $N_w \ll N_2$

phase to phase:

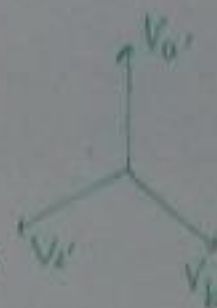


in S.C. condition (F), $\begin{cases} i_{CTB} \neq i_{CTb} \\ i_{CTC} \neq i_{CTc} \end{cases} \Rightarrow \text{operating relay}$

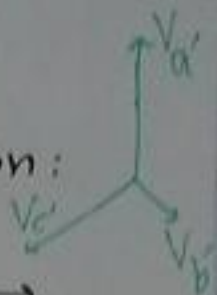
the s.c. of 1 phase winding (a part of):



{ in normal condition:

$$V_a' + V_b' + V_c' = 0 \Rightarrow i_{Relay} = 0$$


{ in s.c. condition:

$$V_a' + V_b' + V_c' \neq 0 \Rightarrow i_{Relay} = \frac{V_a' + V_b' + V_c'}{R_{Relay}} \Rightarrow$$


operating relay

