

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

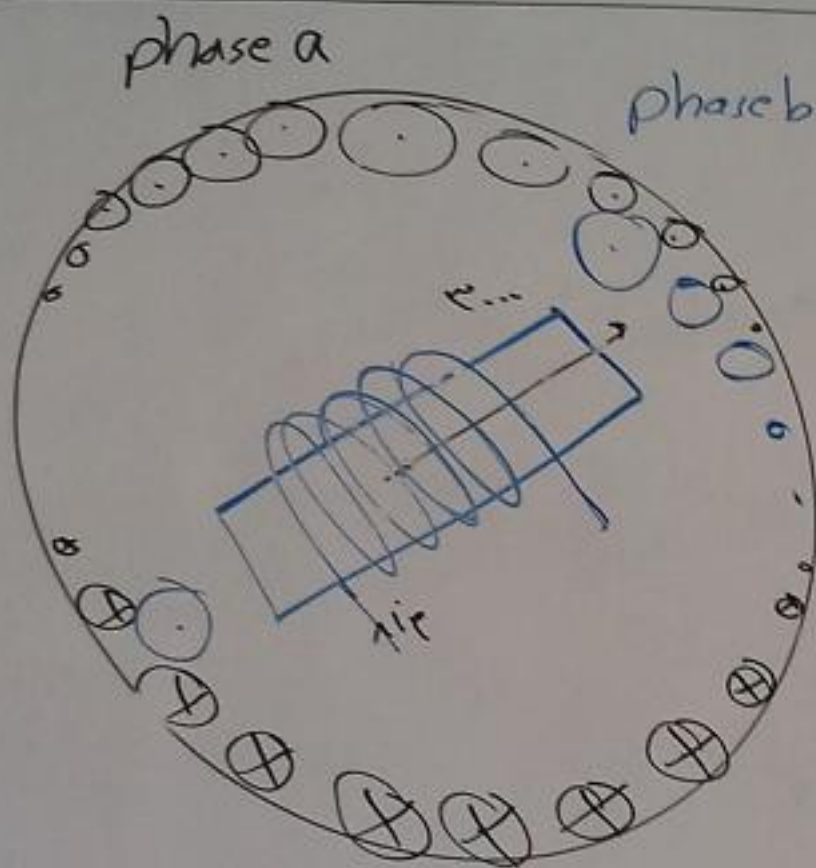
1) generator protection:

extra protection

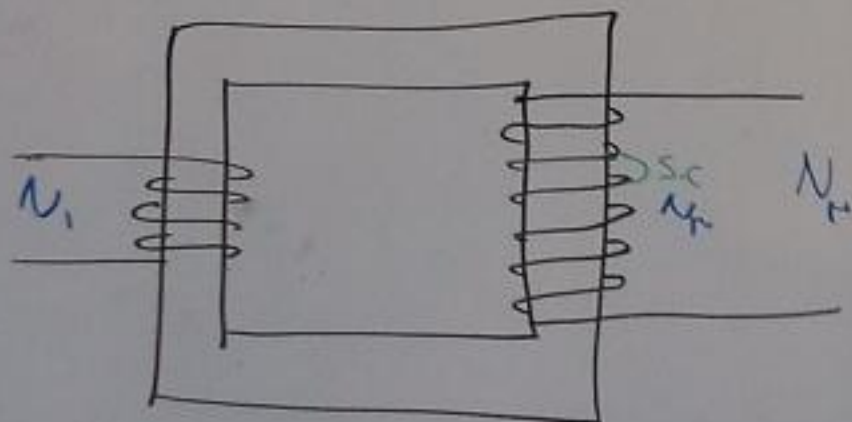
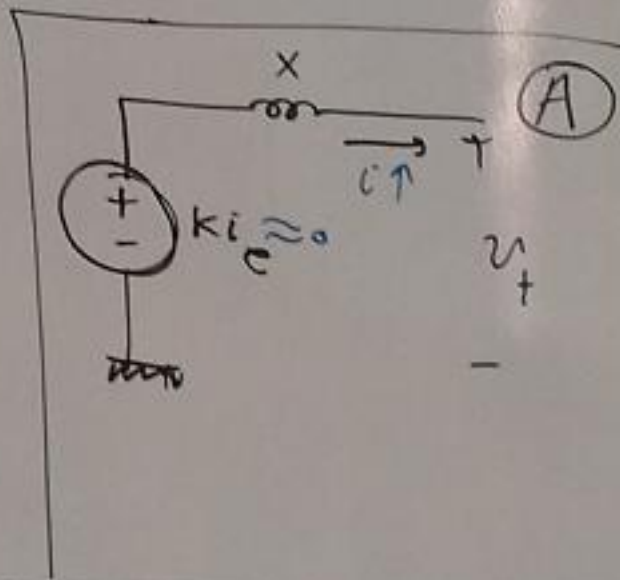
- negative sequence (10% positive sequence)
- under voltage (0.05^{pu})
- over voltage (0.05^{pu})
- under frequency (0.2^{Hz})
- over frequency (0.2^{Hz})
- over flux ($\propto \frac{V}{f}$)
- under flux ($\propto \frac{V}{f}$)
- pole slip

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

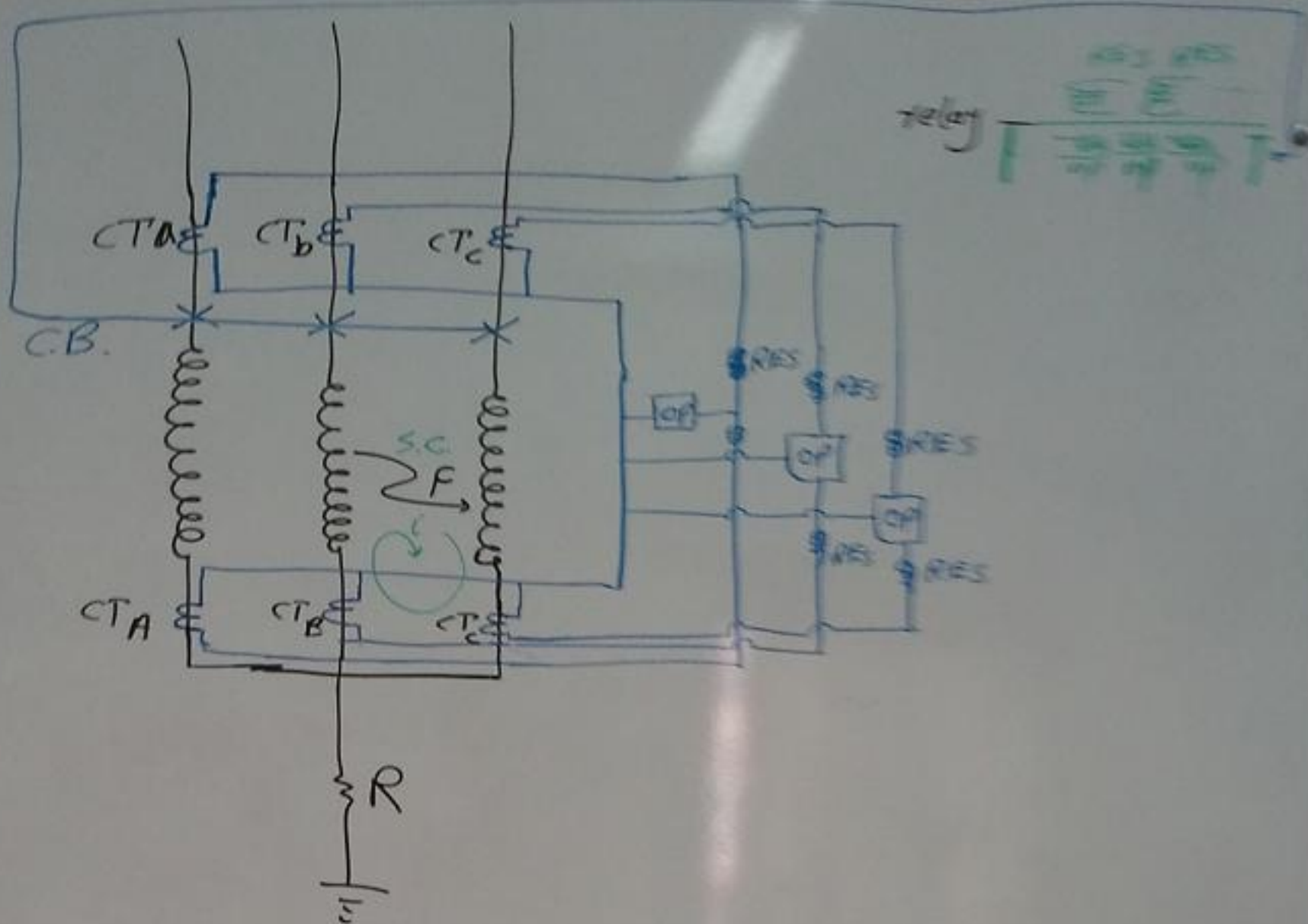


- N_1 : primary winding
- N_2 : secondary winding
- N_{sc} { the number of secondary winding that is shorted

main problem \rightarrow high current in shortened winding

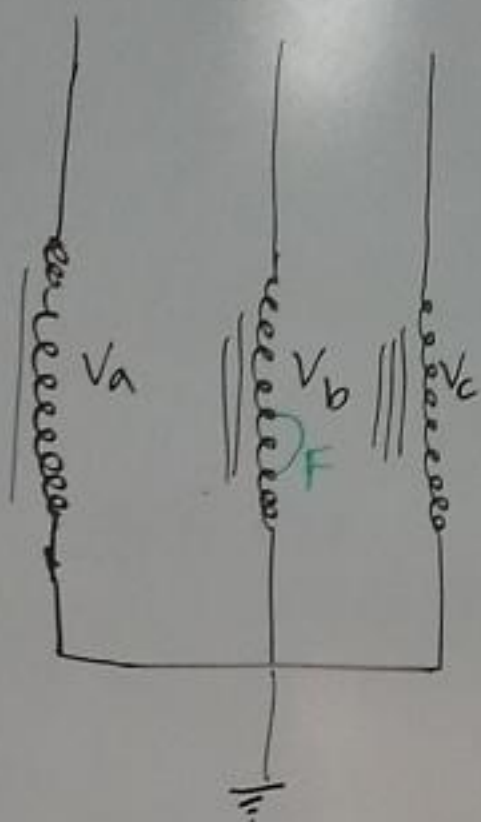
$N_2 \rightarrow N_2 - N_{sc}$
 no important, if $N_{sc} \ll N_2$

phase to phase:

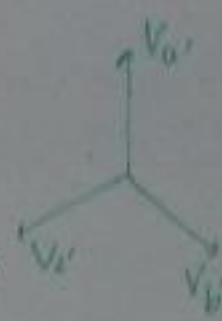


in S.C. condition (F), $\begin{cases} i_{CTB} \neq I_{CTB} \\ i_{CTC} \neq I_{CTC} \end{cases} \Rightarrow \text{operating relay}$

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

