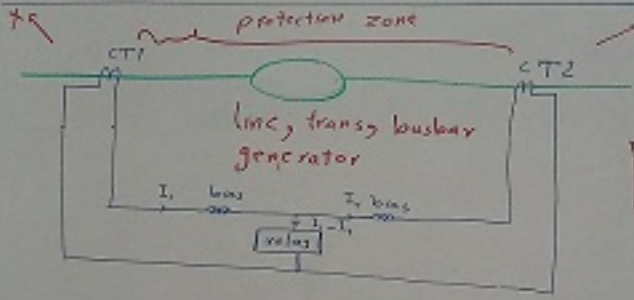
differential relay

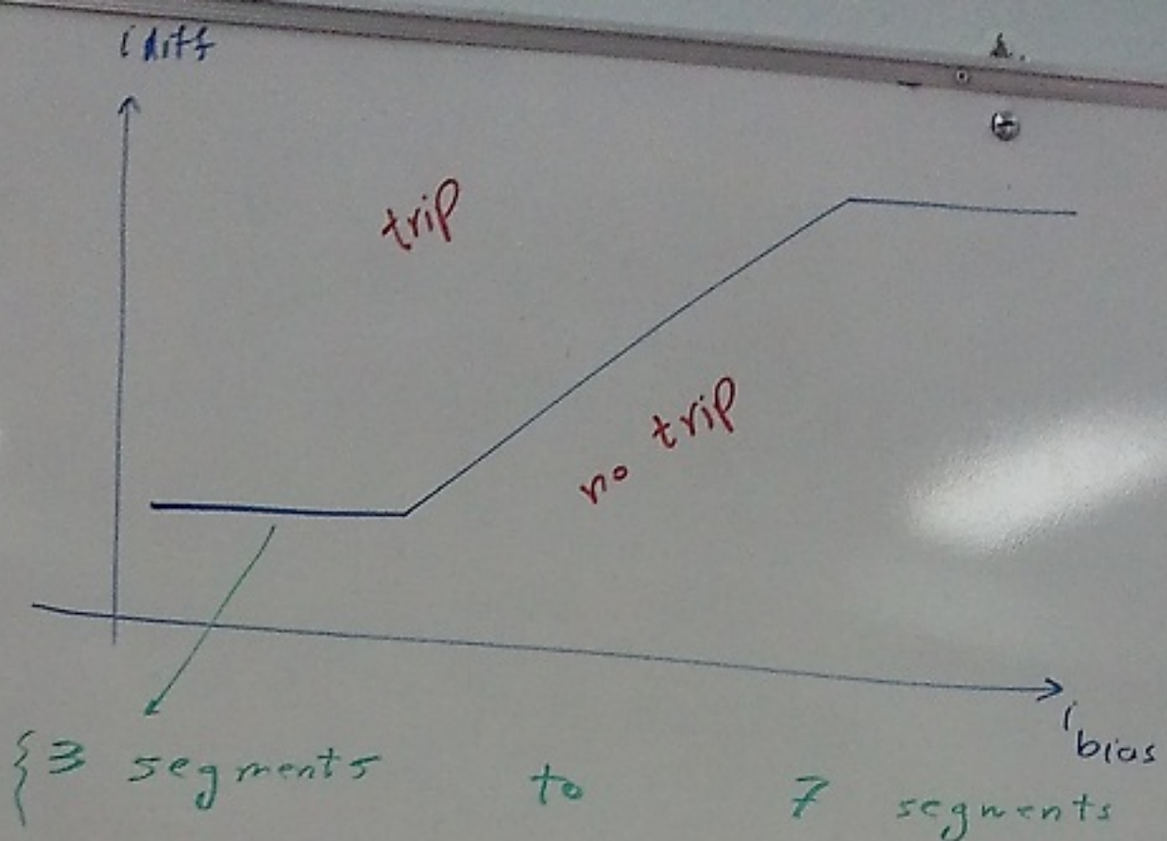
- no coordination
- only one equipment



bias : $\frac{|I_1 + I_2|}{2}$

- N : bias winding
- analog

diff :
- $|I_1 - I_2|$ ✓
- or
- $|I_1| - |I_2|$ ← the various type of differential relays
- or
- $|\angle I_1 - \angle I_2|$

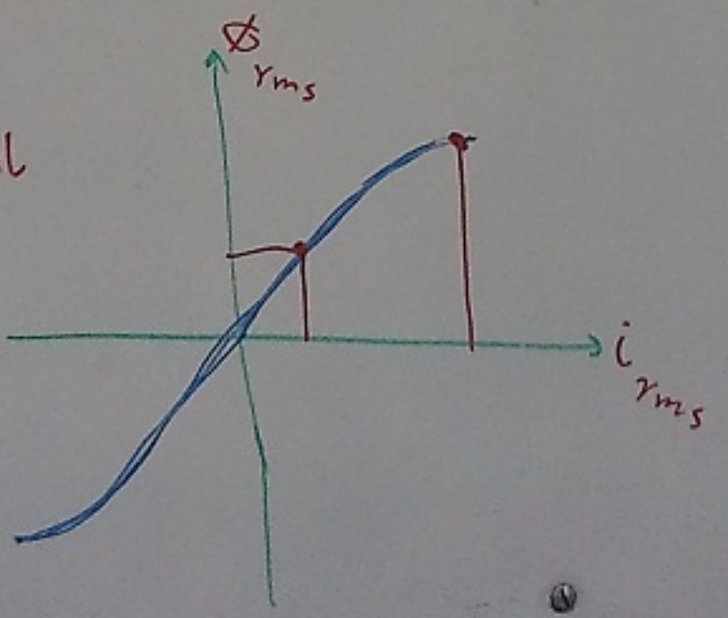


CT Saturation :

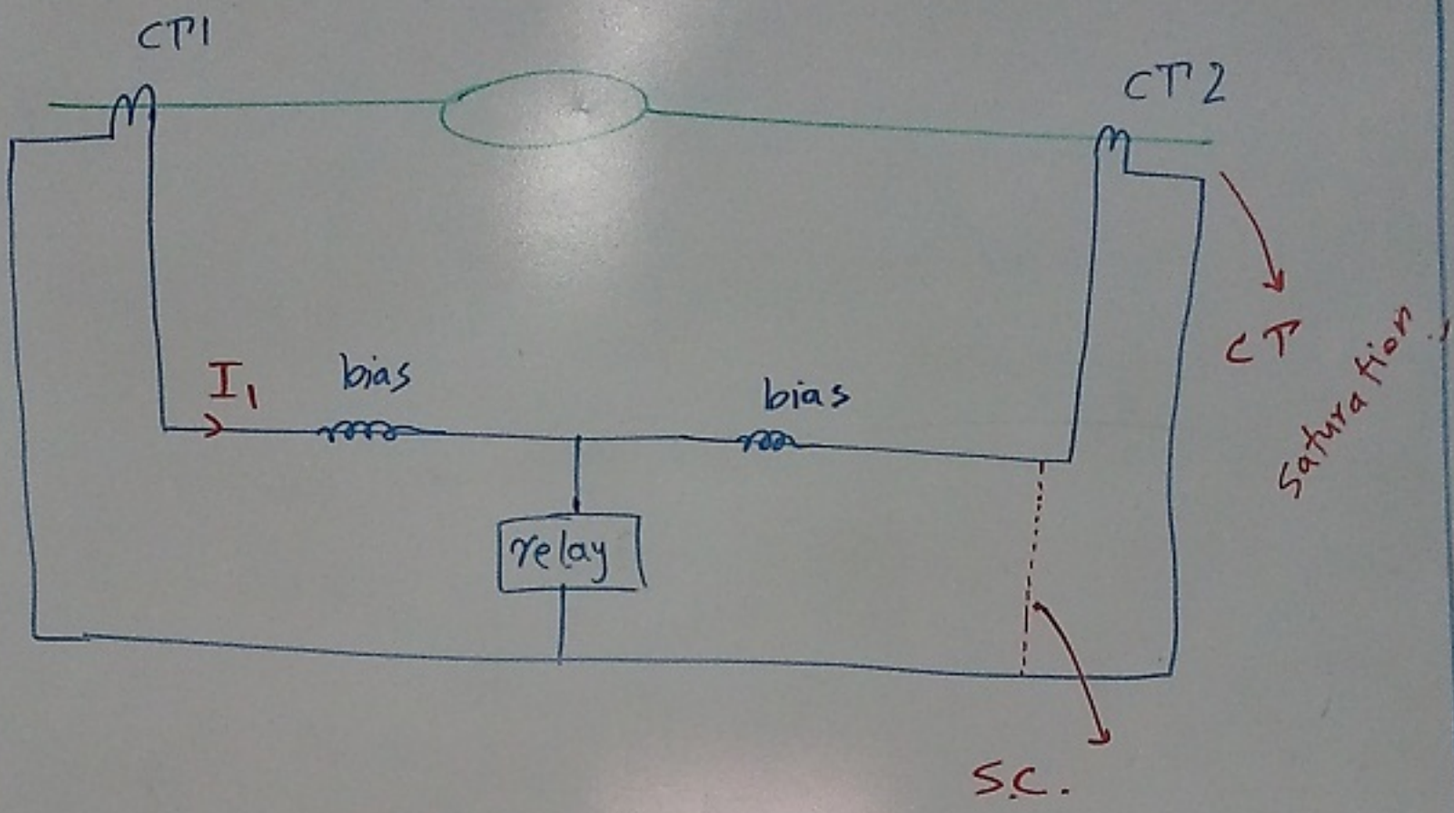
f_{aut} <
- out of protection zone: { bias prevent from sending trip
- in the protection zone: { i_{bias} X ; i_{diff} ✓

transmission line current ⟹

$\phi_{g}i$: sinusoidal



modeling of CT saturation.



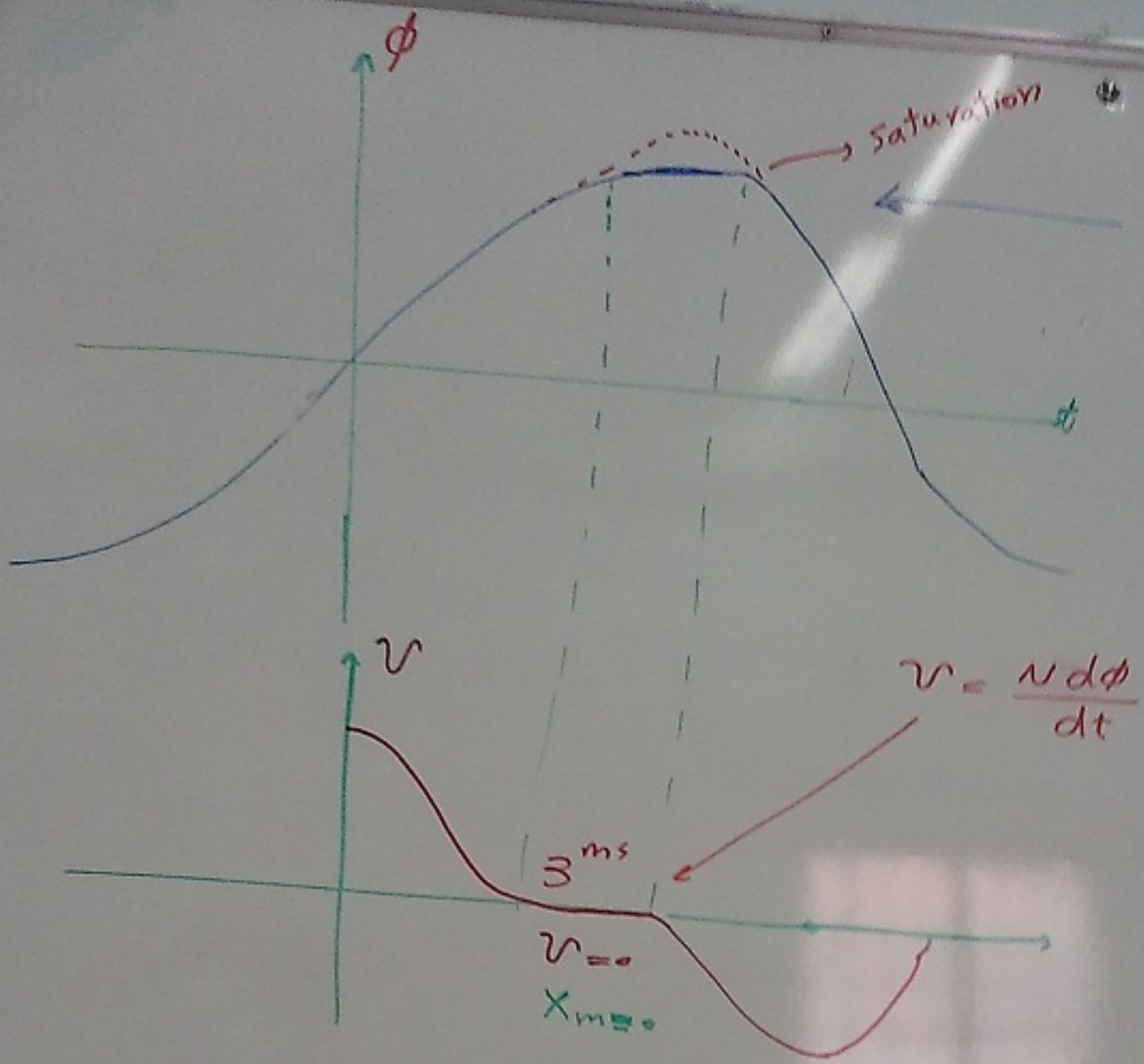
in saturation condition,

i_{bias}, i_{diff} is calculated.

respect to trip graph of differential

relay, it is determined that the relay

send a trip or not.



during saturation, voltage is equal to zero

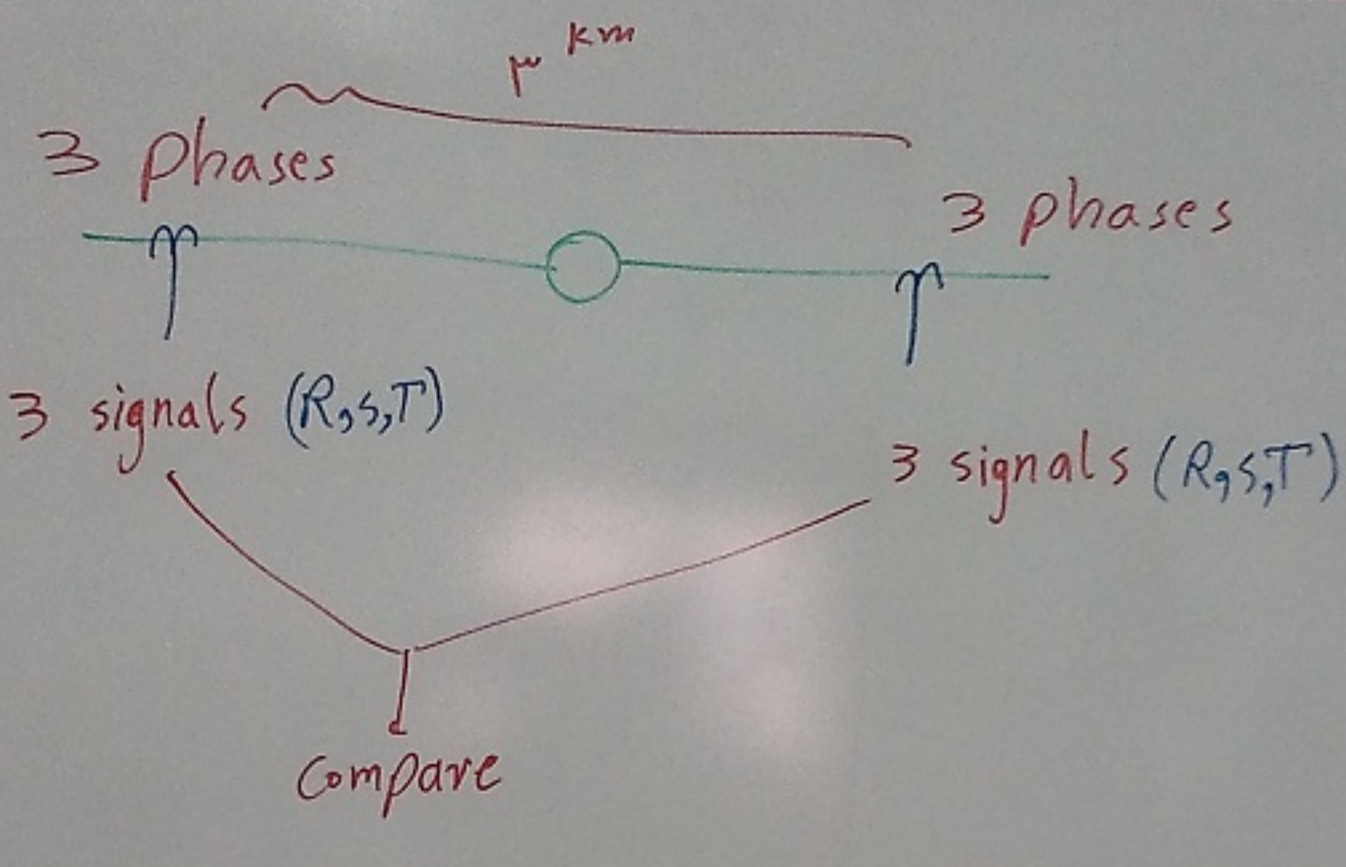
maximum error is when ($v = 0$). ($time \approx 3^{ms}$)

(it is enough to send a trip (operting time of differetial relay is instantaneous)

data communication : (smart grid)

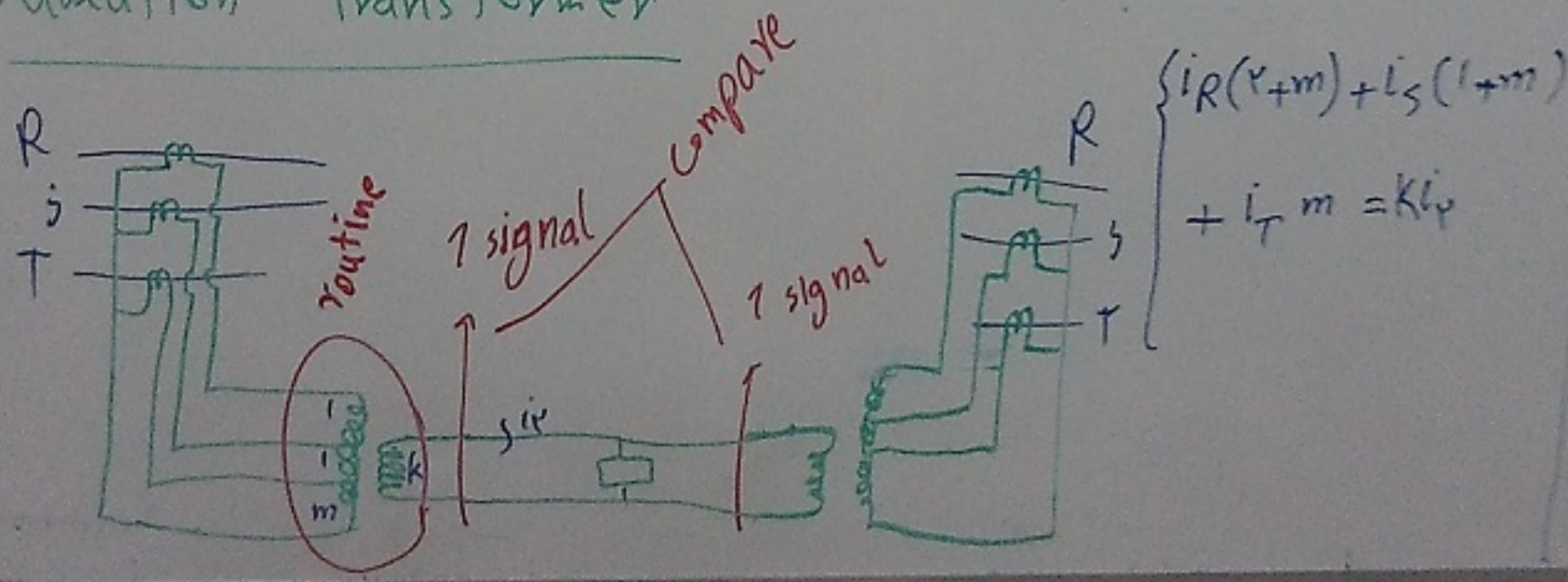
the most important issue is reliability.

private network



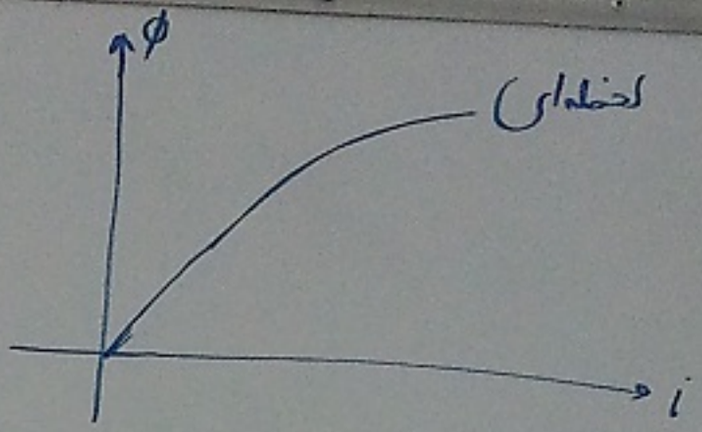
goal: { deacreasing the number of signals ⟹
reliability rising

Sumation transformer



inrush current:

1) saturation



2) $v = N\frac{d\phi}{dt} \rightarrow \phi = \frac{1}{N}\int v\,dt$