Power System Analysis

Topics :-

i) Representing Power System network in p.u. form

ii) Symmetrical components & sequence network

iii) Symmetrical & Unsymmetrical fault Analysis

iv) Power System stability (rotor angular stability)

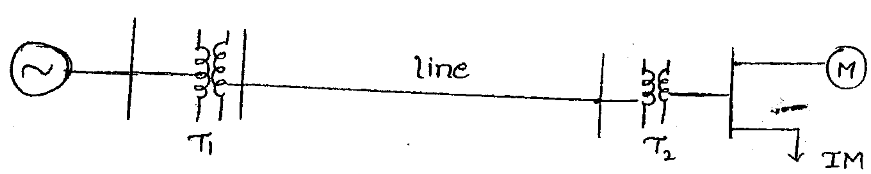
v) Power System Matrices (Y_{bus} & Z_{bus})

vi) Load flow Analysis.

Representing Power System network in p.u. form

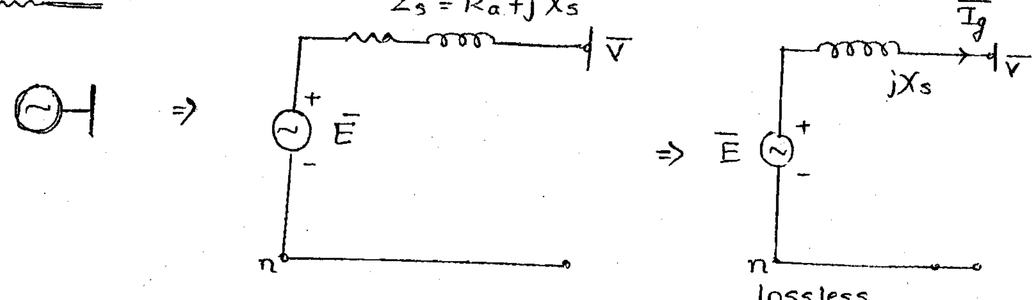
Analysis generally done either in absolute form (Ω, V, A, W ...) in units or in per unit.

Single Line Diagram



assuming that system is balanced.

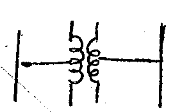
Generator :-

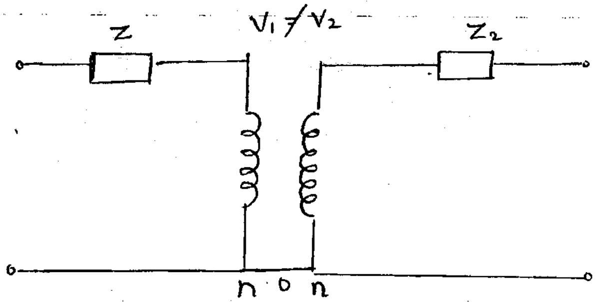


for balanced s/s neutral current = 0

$\Rightarrow V_n = 0$

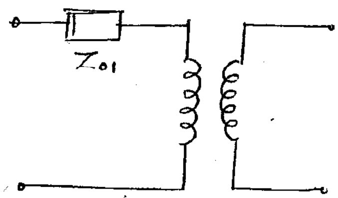
Transformer :-





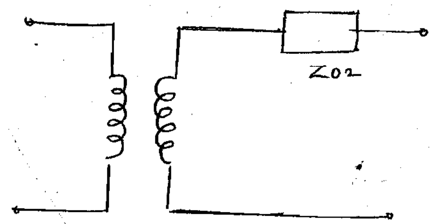
$Z_1, Z_2 \rightarrow$ leakage impedance of T/F winding.

→ Referred to primary side:-



$$Z_{01} = Z_1 + \frac{Z_2}{k^2}$$

Referred to secondary side

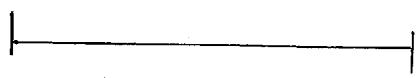


$$Z_{02} = Z_2 + k^2 Z_1$$

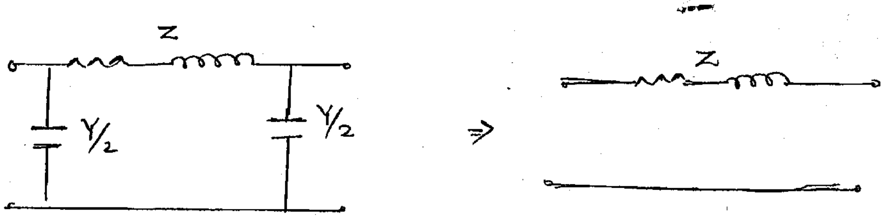
transformation Ratio $k = \frac{N_2}{N_1} = \frac{V_2}{V_1} = \frac{I_1}{I_2}$

$$\boxed{Z_{02} = k^2 \cdot Z_{01}}$$

Transmission Line

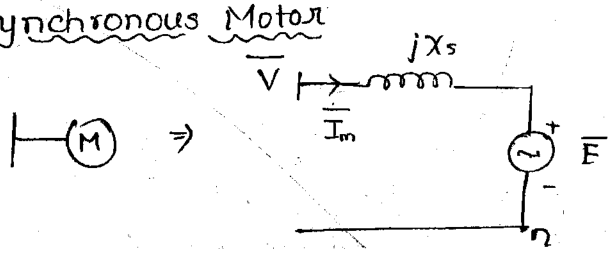


represent either in
- eq - π
- n - π
- short line model

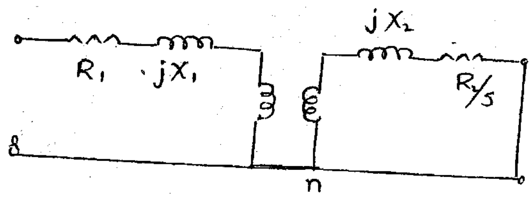


→ During short ckt fault the shunt element of X-mission line may carry negligible amount of current because of it's large impedance. So, in fault analysis always X-mission line will be represent as a short line model.

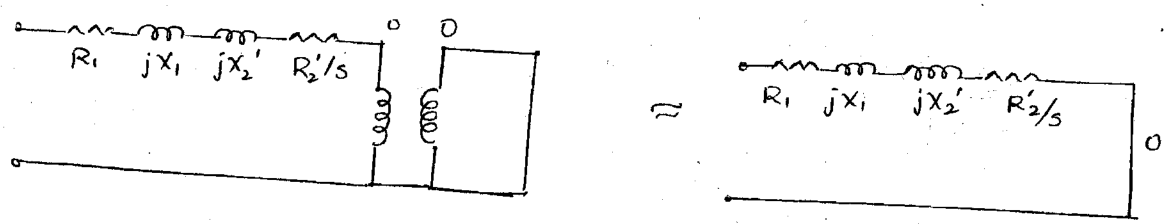
Synchronous Motor



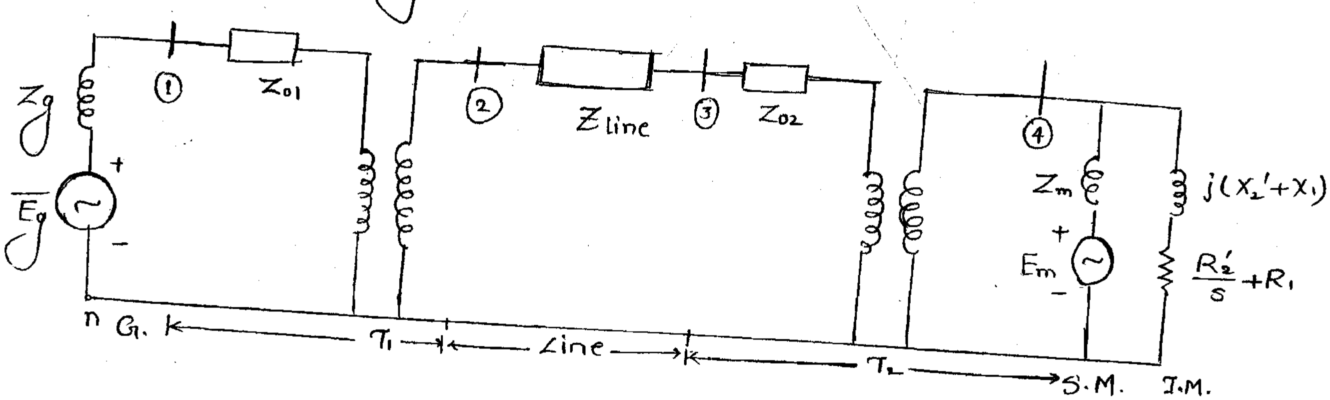
Induction Motor



Referred to primary (~~rotor~~ stator)



Equivalent ckt Diagram



equivalent ckt in absolute value

→ If analysis is done in absolute form there is ~~a~~ discontinuity in the nwk analysis due to the presence couple ckt of X-mer.

→ To avoid this discontinuity in application of KVL or nwk analysis.

Analysis will be done in p.u. form, in which coupled ckt gets removed.

Equivalent ckt in p.u. form :-