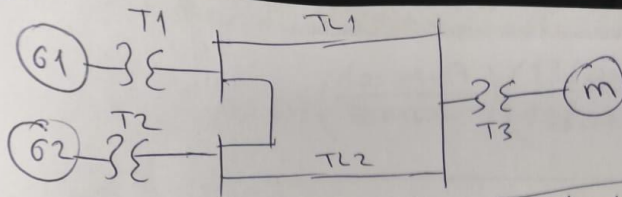


Ex. 1



$$\left. \begin{aligned} S_{base, new} &= 100 \text{ MVA} \\ V_{base, new} &= 138 \text{ kV} \end{aligned} \right\} \text{for Line side}$$

old values are given in the question (not to be in the form of a Table)

For G1:

$$Z_{pu, new} = (Z_{pu, old}) \left(\frac{S_{base, new}}{S_{base, old}} \right) \left(\frac{V_{base, old}^2}{V_{base, new}^2} \right)$$

$$Z_{pu, new} = (j0.15) \left(\frac{100 \text{ MVA}}{45 \text{ MVA}} \right) \left(\frac{13.2 \text{ kV}}{13.8 \text{ kV}} \right)^2 = \textcircled{A} \text{ pu} \checkmark$$

For G2:

$$Z_{pu, new} = (j0.12) \left(\frac{100 \text{ MVA}}{55 \text{ MVA}} \right) \left(\frac{18 \text{ kV}}{19.05 \text{ kV}} \right)^2 = \textcircled{B} \text{ pu}$$

For T1:

$$Z_{pu, new} = (j0.10) \left(\frac{100 \text{ MVA}}{50 \text{ MVA}} \right) \left(\frac{13.8 \text{ kV}}{13.8 \text{ kV}} \right)^2 = \textcircled{C} \text{ pu}$$

For T2:

$$Z_{pu, new} = (j0.10) \left(\frac{100 \text{ MVA}}{60 \text{ MVA}} \right) \left(\frac{19.05 \text{ kV}}{19.05 \text{ kV}} \right)^2 = \textcircled{D} \text{ pu}$$

For TL1:

$$Z_{line1, pu} = \frac{Z_{line1, actual}}{Z_{base, L1}} = \frac{j40}{\frac{V_{base, L1, new}^2}{S_{base, new}}} = \frac{j40}{\frac{138000^2}{100 \times 10^6}} = \textcircled{E} \text{ pu}$$

For TL2:

$$Z_{line2, pu} = \frac{Z_{line2, actual}}{Z_{base, L2}} = \frac{j20}{\frac{V_{base, L2, new}^2}{S_{base, new}}} = \frac{j20}{\frac{138000^2}{100 \times 10^6}} = \textcircled{F} \text{ pu}$$

For TL3:

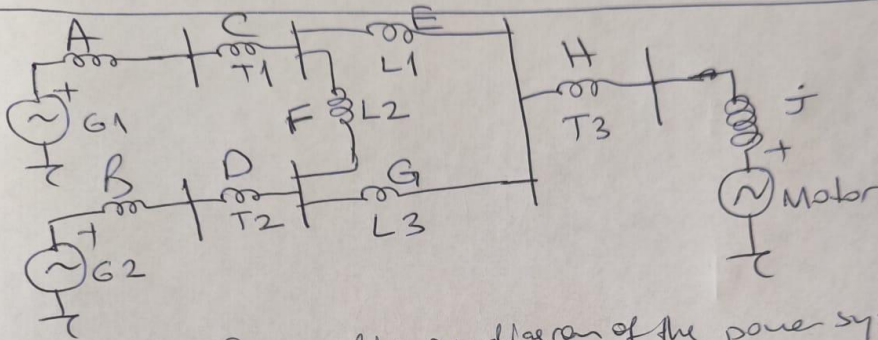
$$Z_{line3, pu} = \frac{Z_{line3, actual}}{Z_{base, L3}} = \frac{j15}{\frac{V_{base, L3, new}^2}{S_{base, new}}} = \frac{j15}{\frac{138000^2}{100 \times 10^6}} = \textcircled{G} \text{ pu}$$

For T3:

$$Z_{pu, new} = (j0.15) \left(\frac{100 \text{ MVA}}{70 \text{ MVA}} \right) \left(\frac{138000^2}{138000^2} \right) = \boxed{j0.15 \text{ pu}}$$

For motor (load):

$$Z_{pu, new} = (j0.23) \left(\frac{100 \text{ MVA}}{75 \text{ MVA}} \right) \left(\frac{116000^2}{116000^2} \right) = \boxed{j0.23 \text{ pu}}$$



Single-line pu diagram of the power system