Assignment - 04

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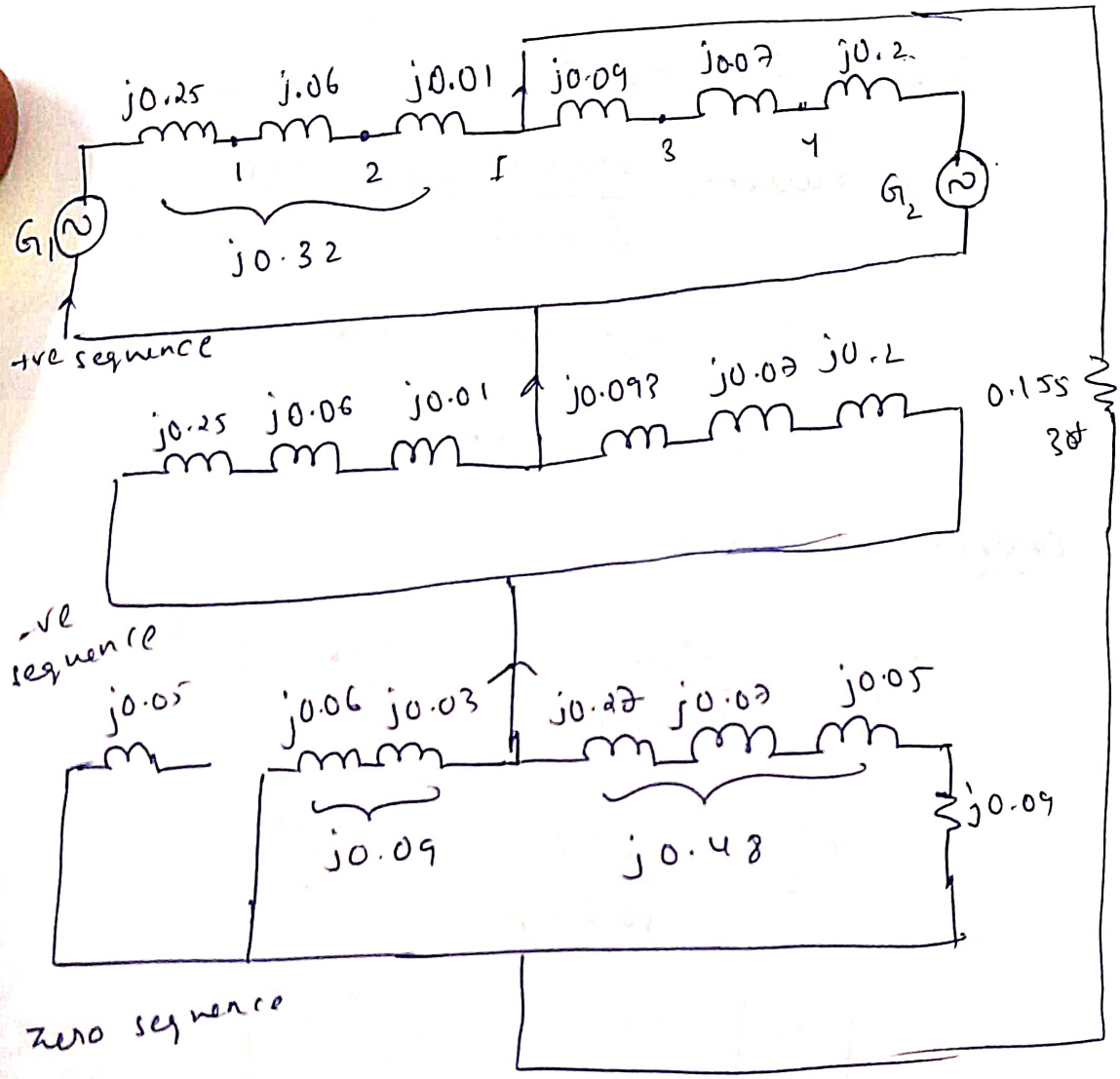
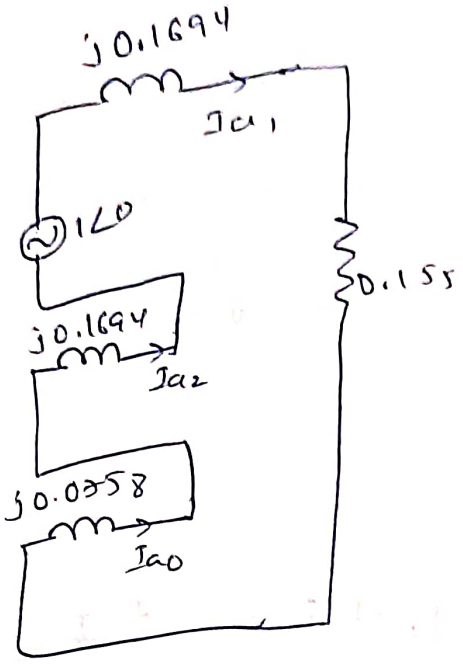


Base MVA = 250 MVA

Base voltage = 11 kV – LT side of transformer
220 kV – HT side of transformer

$$\Rightarrow 3\Phi = \frac{3 \times 10 \times 250}{220 \times 220} = 0.155 \text{ pu}$$



$$I_{a0} = I_{a1} = I_{a2}$$

$$= \frac{1\angle 0}{0.15 + 2(j0.1694) + j0.0258}$$

$$= 2.259\angle -69.5 \text{ pu}$$

$$\begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha^2 & \alpha \\ 1 & \alpha & \alpha^2 \end{bmatrix} \begin{bmatrix} 2.259\angle -69.5 \\ 2.259\angle -69.5 \\ 2.259\angle -69.5 \end{bmatrix} = \begin{bmatrix} 6.777\angle -69.5 \\ 0 \\ 0 \end{bmatrix} \text{pu}$$

$$\text{Base current} = \frac{250 \times 10^6}{\sqrt{3} \times 220 \times 10^3} = 656.07 \text{ A}$$

$$\text{Fault current} = 6.777 \times 656.07 \text{ A}$$

$$I_f = 4446.18 \text{ A}.$$

At Bus 2:

$z_1 = 0.32j$
$z_2 = 0.36j$

+ve seq: $I_f = (I_{a1}) \left(\frac{z_2}{z_1 + z_2} \right)$

$$= 2.259\angle -69.5 \times \left(\frac{0.36}{0.68} \right)$$

$$= 1.195\angle -69.5 \text{ pu}$$

$z_1 = 0.32j$
$z_2 = 0.36j$

-ve seq: $(I_a)_{bus2} = (I_{a2}) \left(\frac{z_2}{z_1 + z_2} \right)$

$$= 2.259\angle -69.5 \times \left(\frac{0.36}{0.68} \right)$$

$$= 1.195\angle -69.5 \text{ pu}$$

Zero sequence: $(I_a)_{bus\,0} = I_{a0} \times \frac{Z_2}{Z_1+Z_2}$

$Z_1 = 0.09\,j$

$Z_2 = 0.42\,j$

$= 2.259\angle -69.5 \times 0.842$

$= 1.9\angle -69.5$ pu

Fault current at bus 2:

$(I_f\ bus)_2 = (I_a\ bus)_0 + (I_a\ bus)_1 + (I_a\ bus)_2$

$= (1.195 + 1.195 + 1.195)\angle -69.5$ pu

$= 4.300\angle -69.5$ pu

Fault current at bus 2 $= 2815.38\,\Phi$.