(a) Line parameters

$$z_s = r_{ac,c} + r_e + j\frac{\omega\mu}{2\pi}\ln\frac{D_e}{d} = 0.0001338 + j\,0.000911 \text{ ohms/m}$$

$$z_{bc} = z_{ab} = r_e + j\frac{\omega\mu}{2\pi}\ln\frac{D_e}{d_{ab}} = 0.00005929 + j\,0.000489 \text{ ohms/m}$$

$$z_{ac} = r_e + j\frac{\omega\mu}{2\pi}\ln\frac{D_e}{d_{ac}} = 0.00005929 + j\,0.000436 \text{ ohms/m}$$

Computing TzT^{-1}, eliminating off diagonals, yields

$$z_2 = z_1 = 0.000745 + j\,0.000439 \text{ ohms/m}$$

$$z_0 = 0.000252 + j\,0.001853 \text{ ohms/m}$$

40 mile section of line $\Rightarrow$ $z_1 = z_2 = 4.8 + j\,28.254$ ohms

$z_0 = 12.432 + j\,119.259$ ohms

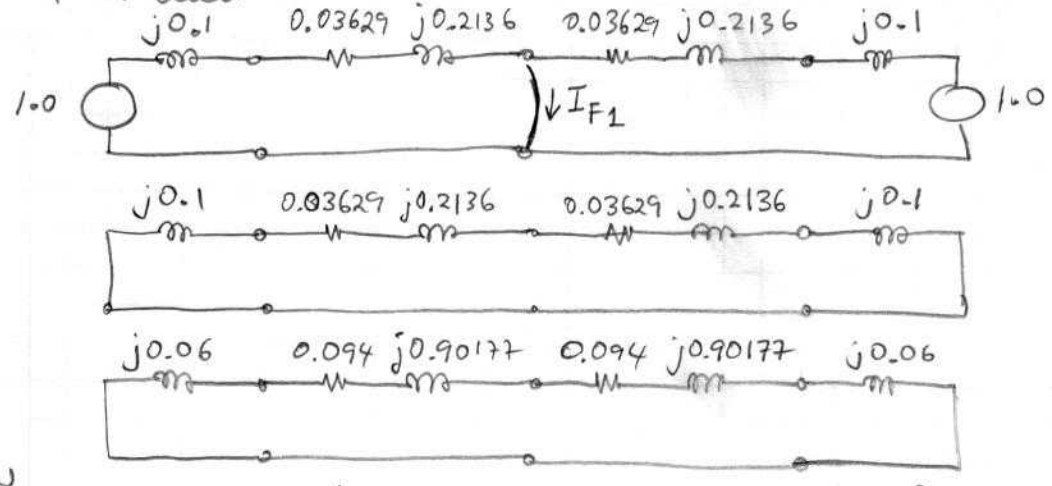
Convert to pu

Impedance Base: $z_B = 115^2/100 = 132.25$ ohm

$\Rightarrow$ $z_{1u} = z_{2u} = 0.03629 + j\,0.2136$

$z_{0u} = 0.094 + j\,0.90177$

3φ Fault



$$\tilde{I}_{F1} = 2\,\frac{1}{0.03629 + j\,0.3136} = 6.3352\,e^{-j83.399^\circ}$$

(Note $\tilde{I}_2 = \tilde{I}_0 = 0$)

$$I_{Base} = (100/3)/(115/\sqrt{3}) = 0.502 \text{ kA}$$

Fault Currents

$$\tilde{I}_{aF} = 3.1805 \text{ kV}\; e^{-j83.399^\circ}$$

$$\tilde{I}_{bF} = 3.1805 \text{ kV}\; e^{-j203.399^\circ}$$

$$\tilde{I}_{cF} = 3.1805 \text{ kV}\; e^{-j323.399^\circ}$$