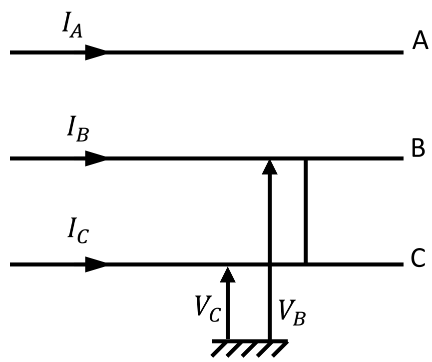
Line to line Faults

the line to land false takes place on phase b and C

the essential conditions are:



$$I_A = 0$$
$$I_B + I_C = 0\,, \quad I_B = -I_C$$
$$V_B = V_C$$

Using the relation

$$\begin{bmatrix} I_A^{(0)} \\ I_A^{(1)} \\ I_A^{(2)} \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} I_A \\ I_B \\ I_C \end{bmatrix}$$

$$I_A^{(0)} = 0$$
$$I_A^{(1)} = \frac{1}{3}(a - a^2)I_B$$
$$I_A^{(2)} = \frac{1}{3}(a^2 - a)I_B$$
$$I_A^{(2)} = -I_A^{(1)}$$

Which means for a Line-to-Line fault zero sequence component of current is absent and positive sequence component of current is equal in magnitude but opposite in phase to negative sequence component of current.

Now from:

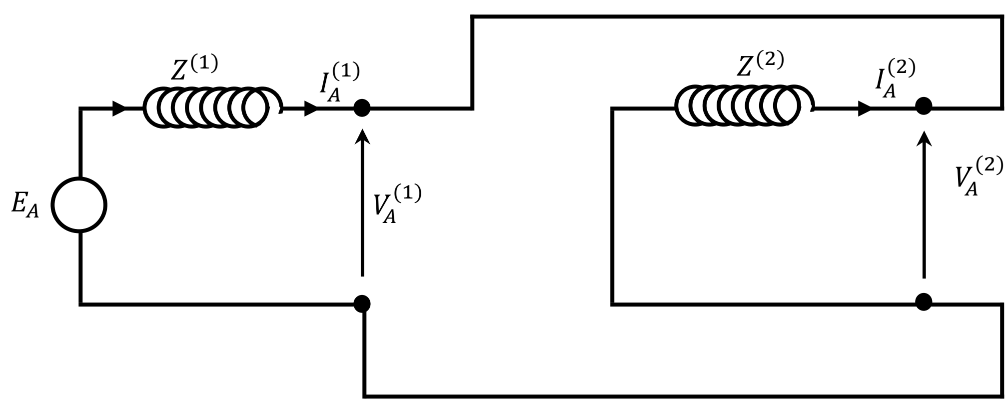
$$V_B = V_C$$
$$V_A^{(0)} + a^2 V_A^{(1)} + a\, V_A^{(2)} = V_A^{(0)} + a\, V_A^{(1)} + a^2\, V_A^{(2)}$$
$$(a^2 - a)V_A^{(1)} = (a^2 - a)V_A^{(2)}$$
$$V_A^{(1)} = V_A^{(2)}$$

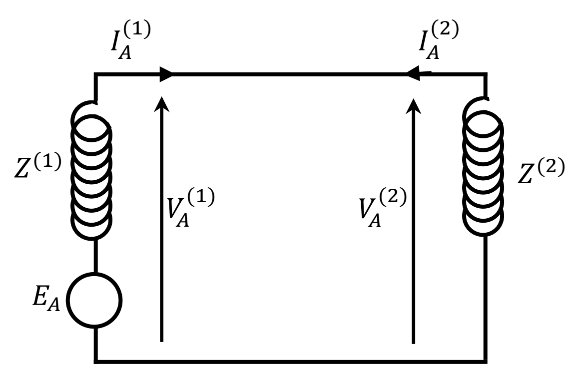
That is, positive sequence component of voltage equals the negative sequence component of voltage. This also means that the two sequence Networks are connected in opposition, now:

$$V_A^{(1)} = V_A^{(2)}$$
$$E_A - I_A^{(1)} Z^{(1)} = -I_A^{(2)} Z^{(2)} = I_A^{(1)} Z^{(2)}$$

$$\boxed{I_A^{(1)} = \frac{E_A}{Z^{(1)} + Z^{(2)}}}$$

The interconnection of the sequence network for simulation of LL fault is shown in figure below:

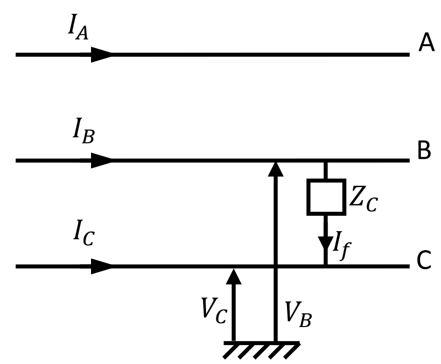




Line to Line fault with Z_f

The fault impedance in Z_f between two lines (B-C)

Sine $V_B = V_c + Z_f\, I_f$



$$I_A = 0$$

$$V_B - V_c = Z_f\, I_f$$

$$I_B = I_B = I_f$$

$$I_C = -I_B = -I_f$$

With same work in previous part, we have

$$I_A^{(0)} = 0$$

$$I_A^{(1)} = \frac{E_A}{Z_1 + Z_2 + Z_f}$$

$$I_A^{(2)} = -I_A^{(1)}$$