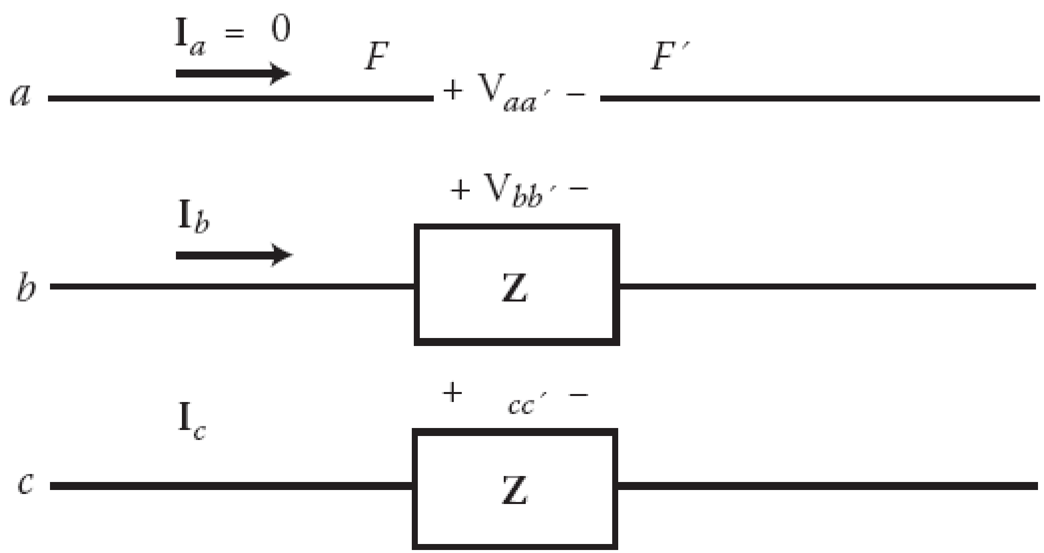
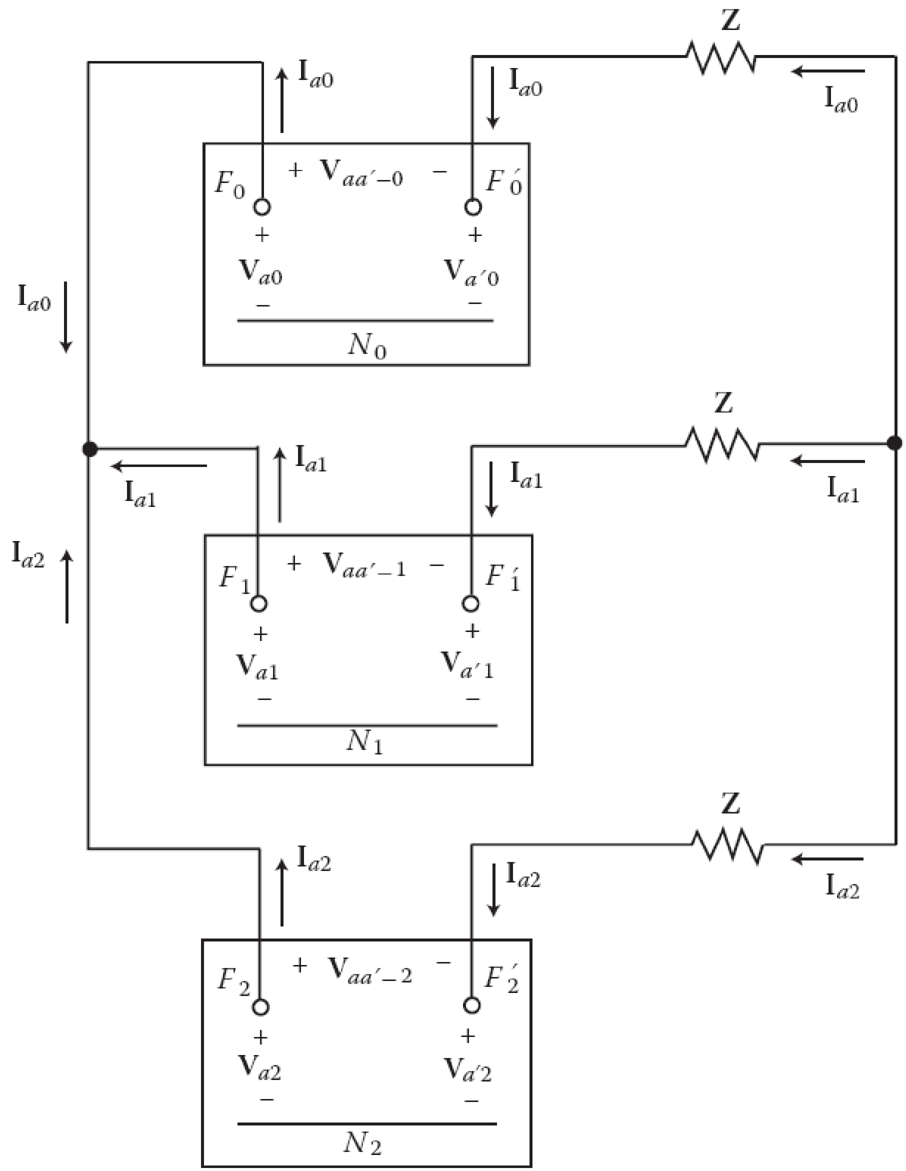
GANGGUAN SERI

In general, series (longitudinal) faults are due to an unbalanced series impedance condition of the lines. One or two broken lines, or an impedance inserted in one or two lines, may be considered as *series faults*. In practice, a series fault is encountered, for example, when line (or circuits) are controlled by circuit breakers (or by fuses) or any device that does not open all three phases; one or two phases of the line (or the circuit) may be open while the other phases or phase is closed.



(a)



(b)

FIGURE 6.19 One line open: (a) general representation; (b) connection of sequence networks.

One Line Open

From Figure 6.19, it can be observed that the line impedance for the open-line conductor in phase *a* is infinity, whereas the line impedances for the other two phases have some finite values. Hence, the positive-, negative-, and zero-sequence currents can be expressed as

$$\mathbf{I}_{a1} = \frac{\mathbf{V}_F}{\mathbf{Z} + \mathbf{Z}_1 + (\mathbf{Z} + \mathbf{Z}_0)(\mathbf{Z} + \mathbf{Z}_2)/(2\mathbf{Z} + \mathbf{Z}_0 + \mathbf{Z}_2)} \tag{6.94}$$

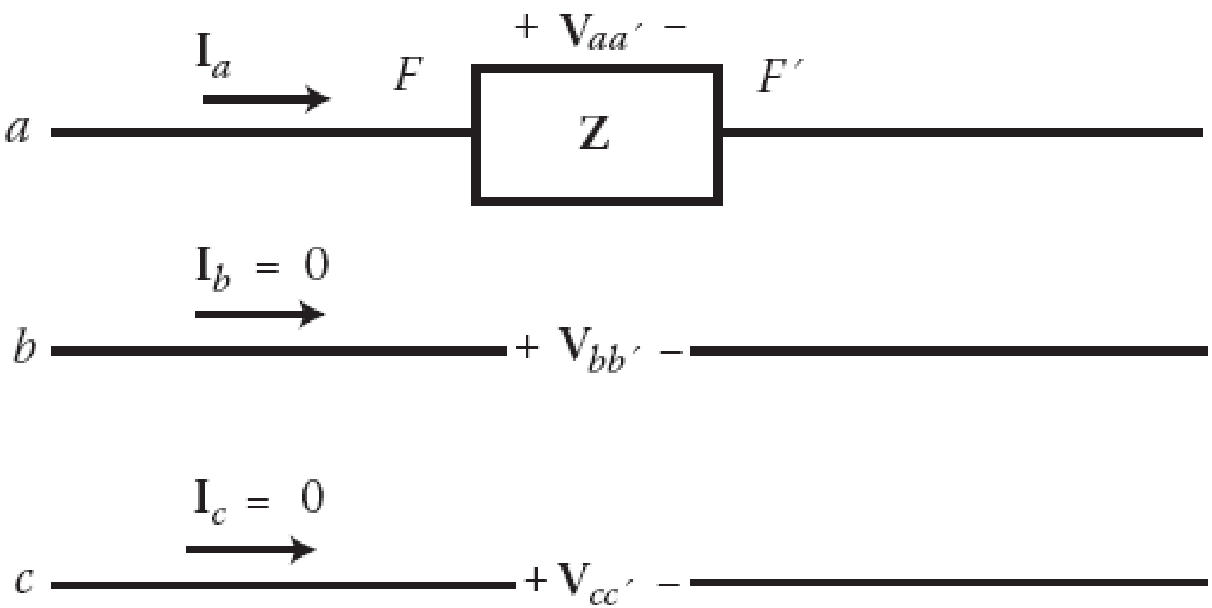
$$\mathbf{I}_{a2} = \left(-\frac{\mathbf{Z} + \mathbf{Z}_0}{2\mathbf{Z} + \mathbf{Z}_0 + \mathbf{Z}_2} \right) \mathbf{I}_{a1} \tag{6.95}$$

$$\mathbf{I}_{a0} = \left(-\frac{\mathbf{Z} + \mathbf{Z}_2}{2\mathbf{Z} + \mathbf{Z}_0 + \mathbf{Z}_2} \right) \mathbf{I}_{a1} \tag{6.96}$$

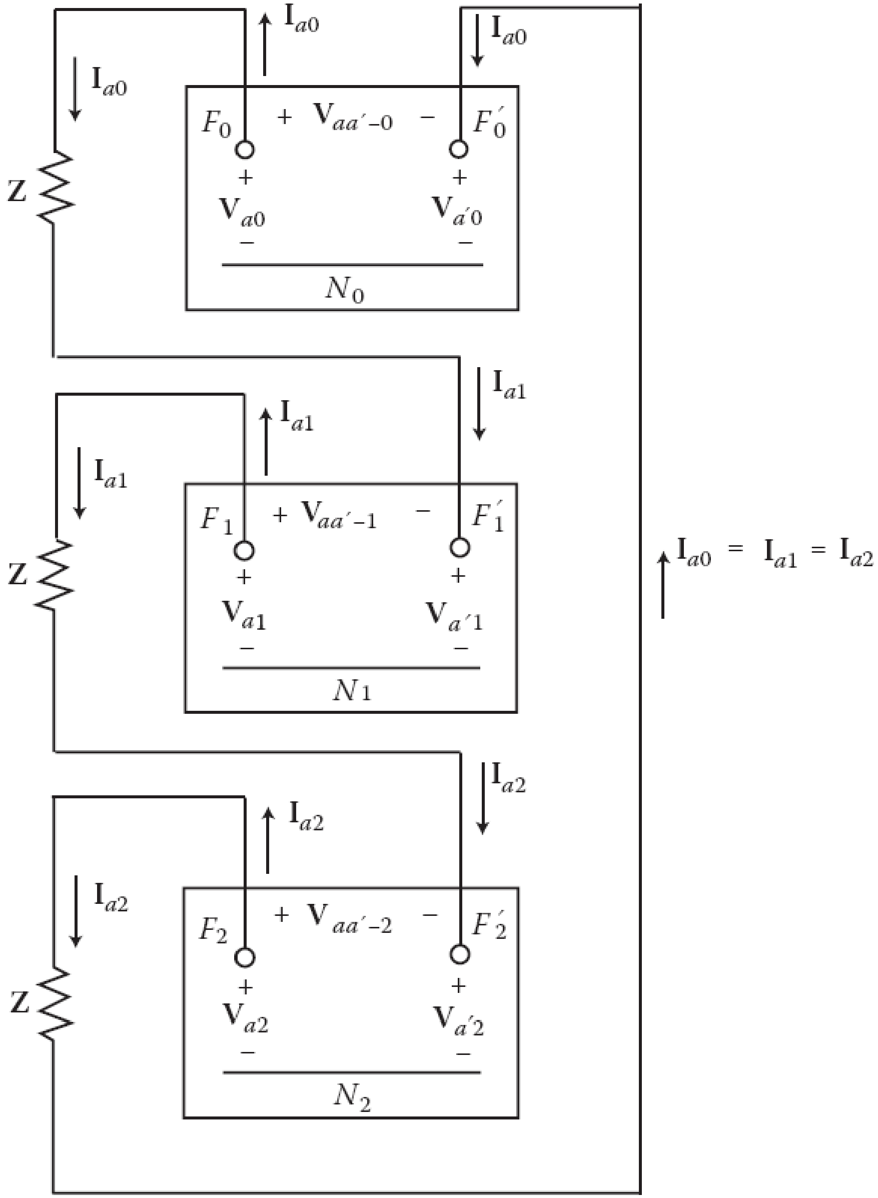
$$\mathbf{I}_{a0} = -(\mathbf{I}_{a1} + \mathbf{I}_{a2}) \tag{6.97}$$

Two Lines Open

If two lines are open as shown in Figure 6.20, then the line impedances for one line open (TLO) in phases *b and c are infinity, whereas the line impedance of phase a has some finite value.*



(a)



(b)

$$\mathbf{I}_b = \mathbf{I}_c = 0$$

$$\mathbf{V}_{aa'} = \mathbf{Z}\mathbf{I}_a$$

$$\mathbf{I}_{a1} = \mathbf{I}_{a2} = \mathbf{I}_{a0} = \frac{\mathbf{V}_F}{\mathbf{Z}_0 + \mathbf{Z}_1 + \mathbf{Z}_2 + 3\mathbf{Z}_f}$$