# Norton's Theorem:

Any two terminal linear network containing energy source and impedances can be replaced by an equivalent circuit containing of a current source I' in parallel with an admittance Y'. The value of I' is the short-circuit current between the terminals of the network and Y' is the admittance measured between the terminals with all energy sources eliminated (but not their admittances).

The circuit is Fig (1) (a) at terminals a, a can be replaced by fig (1) (b); provided.

$$I' = \frac{E'}{Z'} \quad \text{——— (1)}$$

$$= E'Y' \quad \text{——— (2)}$$

In the circuit in fig (1) (a), the load current

$$I_R = \frac{E'}{Z'+Z_R} = \left(\frac{E'}{Z'}\right)\left(\frac{Z'}{Z'+Z_R}\right)$$

$$= I'\left(\frac{Z'}{Z'+Z_R}\right) \quad \text{--- (3)}$$

or, $$I_R = \frac{E'}{\frac{1}{Y'}+\frac{1}{Y_R}} = E'Y'\left(\frac{Y_R}{Y'+Y_R}\right)$$

$$= I'\left(\frac{Y_R}{Y'+Y_R}\right) \quad \text{--- (4)}$$

Where, $Z' = \frac{1}{Y'}$ and $Z_R = \frac{1}{Y_R}$

From fig-1 (b), the load current

$$I'_R = I'\left(\frac{Z'}{Z'+Z_R}\right) \quad \text{--- (5)}$$

$$= I'\left(\frac{Y_R}{Y'+Y_R}\right) \quad \text{--- (6)}$$

From eqn. (5) to (6), the load current $I'_R$ may be made equal to $I_R$ in the circuit in fig 1 (a), if

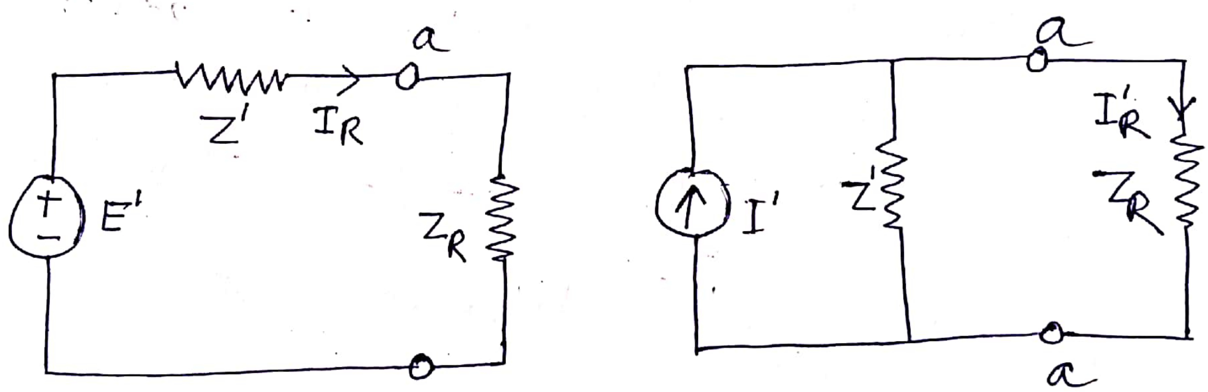
$$I' = \frac{E'}{Z'} \quad \text{--- (7)}$$

$$= E'Y' \quad \text{--- (8)}$$

Where, $$Y' = \frac{1}{Z'} \quad \text{--- (9)}$$

Then the circuit in figs 1 (a) and (b) are equivalent. Current $I'$ is the short-circuit current at terminals a, a and $Z'$ ($Y'$) is the impedance (admittance) measured between the terminals, with all energy sources eliminated but not the impedance (admittances) of the circuit in fig 1 (a).

Norton's theorem is used to get the current source equivalent circuit.




(a) (b)

Fig 1. Norton's circuit illustrations.