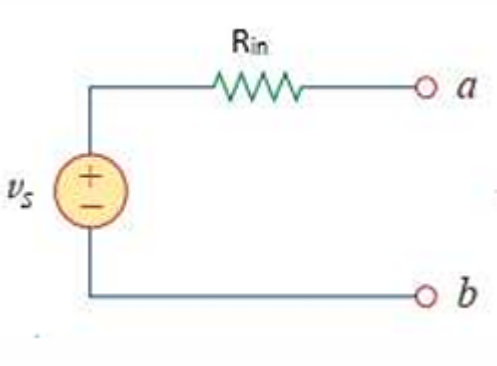
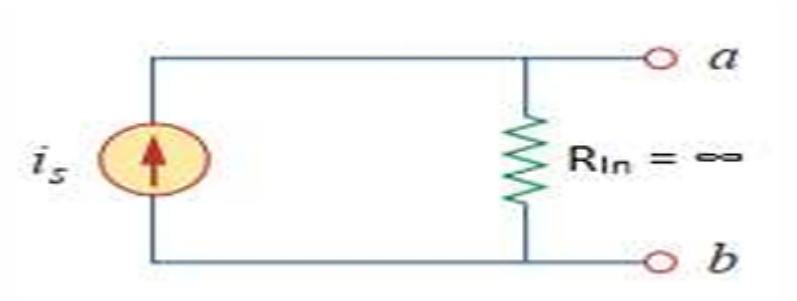
6 - Source Transformation

Ideal voltage source have no internal resistance

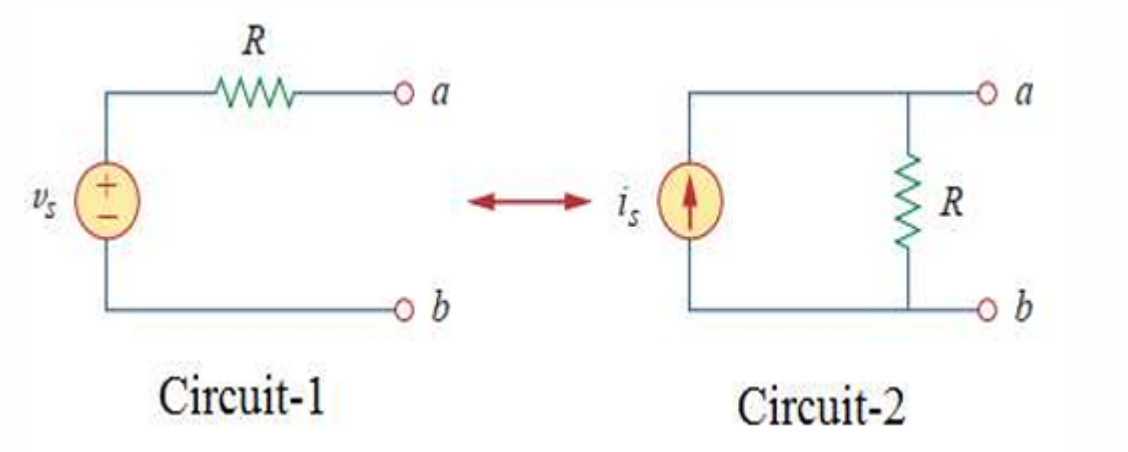
Practical voltage source have series connected small internal resistance



Ideal current source have internal resistance. Internal resistance and current source are connected in parallel. Value of internal resistance is infinite.

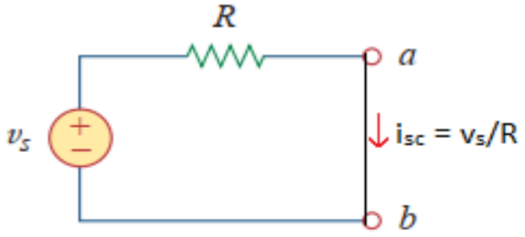


A voltage source in series with a resistor can be transformed to a current source in parallel with a resistor and a current source in parallel with a resistor can be transformed to a voltage source in series with a resistor

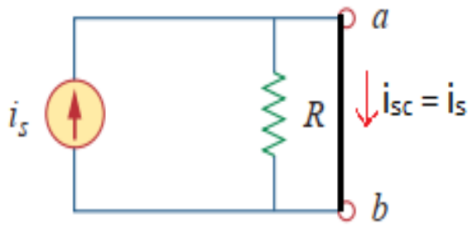


The two circuits in above figure are equivalent when they have the same voltage-current relation at terminals a-b

When terminals a-b of circuit-1 are short circuited, then the short-circuit current flowing from a to b is $i_{sc} = \frac{v_s}{R}$.



When terminals a-b of circuit-2 are short-circuited, then the short-circuit current flowing from a to b is $i_{sc} = i_s$.



Two circuits in above figure are equivalent when short circuit current are same. So relation of source transformation is

$$i_s = \frac{v_s}{R}$$

Source transformation is the process of replacing a voltage source v_s in series with a resistor R by a current source i_s is in parallel with a resistor R, or vice versa

- Source transformation is not possible when $R = 0$
- Arrow of the current source is directed toward the positive terminal of the voltage source (as per following figure)