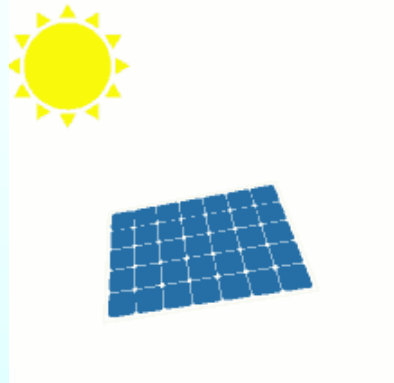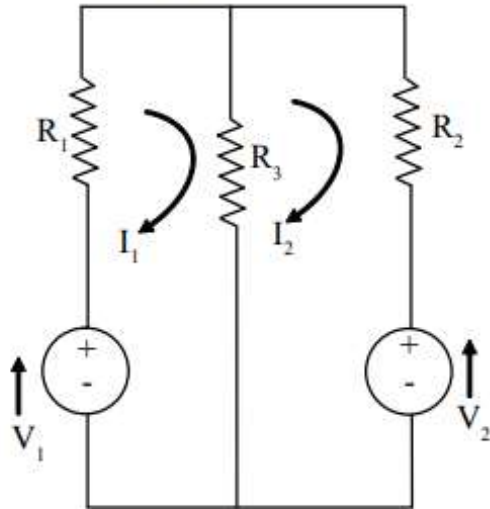# Superposition Theorem
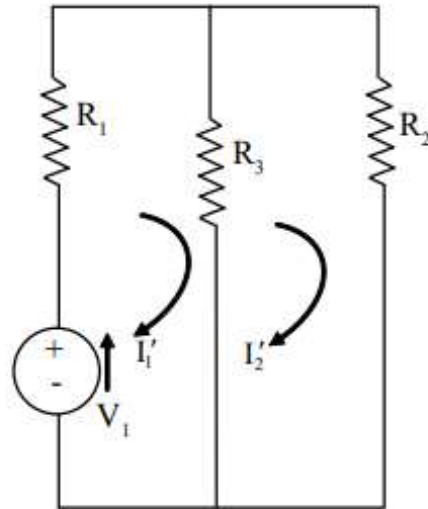

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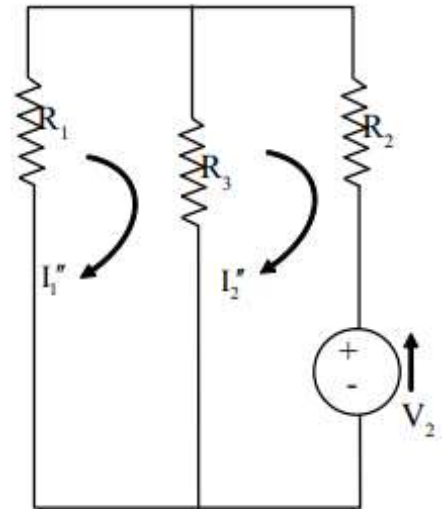
Superposition Theorem

Fig.1   *Fig.2*   *Fig.3*

Statement :

"In a linear, bilateral network containing more than one source, the current through any branch is the algebraic sum of currents which would flow in that branch by considering one source at a time while the other source is reduced to zero.

$$I_1 = I_1' + I_1''$$

$$I_2 = I_2' + I_2''$$

Proof :

Applying KVL by inspection in fig. (1), we get

$$\begin{bmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} V_1 \\ -V_2 \end{bmatrix}$$

$$(R_1 + R_3) I_1 - R_3 I_2 = V_1$$

$$-R_3 I_1 + (R_2 + R_3) I_2 = -V_2$$

Applying KVL by inspection in fig. (2), we get

$$\begin{bmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{bmatrix} \begin{bmatrix} I_1' \\ I_2' \end{bmatrix} = \begin{bmatrix} V_1 \\ 0 \end{bmatrix}$$

$$(R_1 + R_3) I_1' - R_3 I_2' = V_1$$

$$-R_3 I_1' + (R_2 + R_3) I_2' = 0$$

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Applying KVL by inspection in fig (3). we get

$$\begin{bmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{bmatrix} \begin{bmatrix} I_1'' \\ I_2'' \end{bmatrix} = \begin{bmatrix} 0 \\ -V_2 \end{bmatrix}$$

$$(R_1 + R_3) I_1'' - R_3 I_2'' = 0$$

$$-R_3 I_1'' + (R_2 + R_3) I_2'' = -V_2$$

$$I_2 = I_2' + I_2''$$

Thank You