Ex. No. 13	CIRCUIT ANALYSIS WITH DEPENDENT SOURCES
Date:	

AIM:

1. To model dependent voltage sources and current sources in LT Spice
2. To find the nodal voltages and branch currents

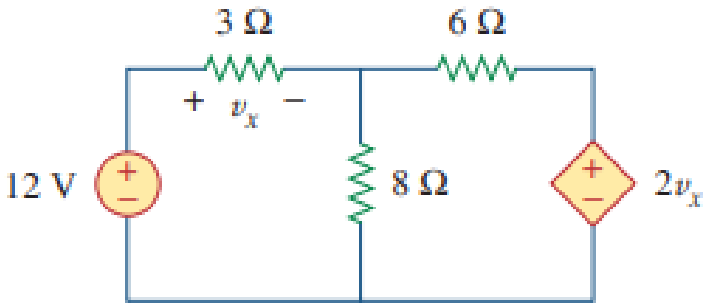
SIMULATION SOFTWARE:

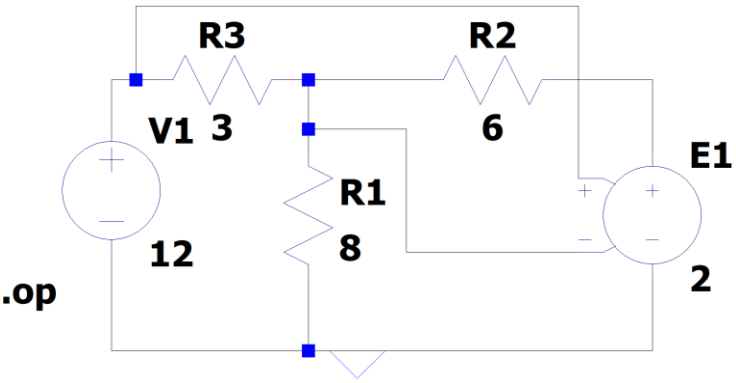
LT Spice – DC operating point analysis and transient analysis.

CIRCUITS:

Voltage Controlled Voltage Source (VCVS):

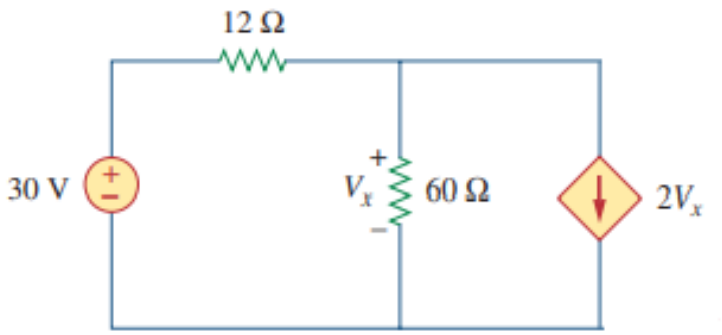
- **Find Vx**

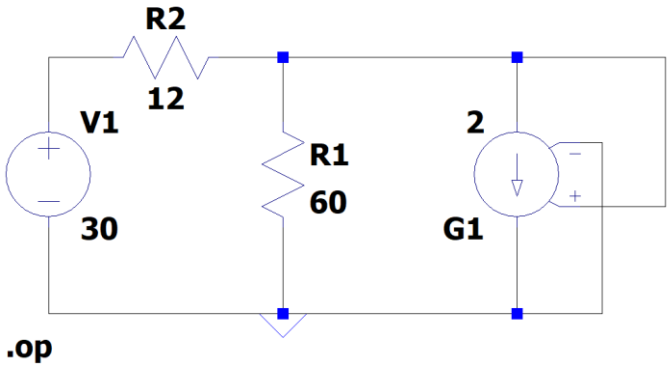




Voltage Controlled Current Source (VCCS):

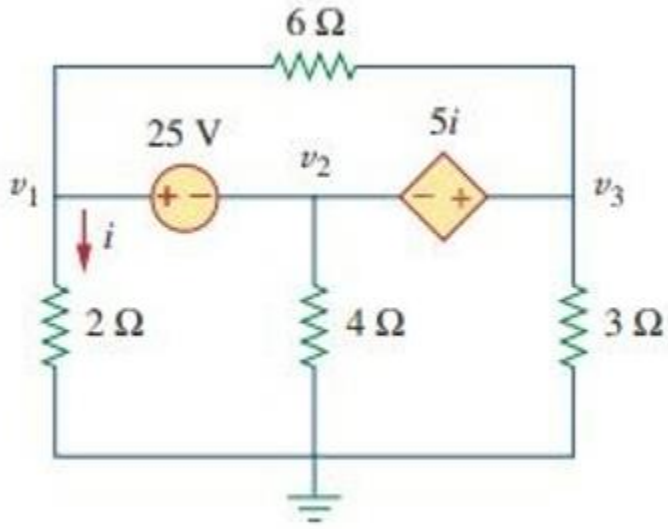
- **Find Vx**

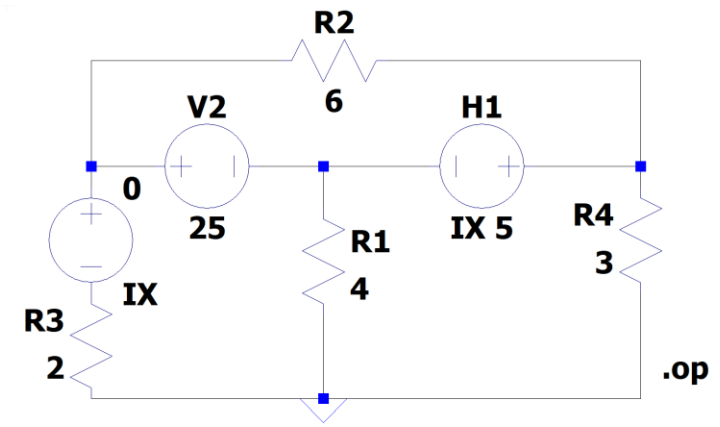




Current Controlled Voltage source (CCVS):

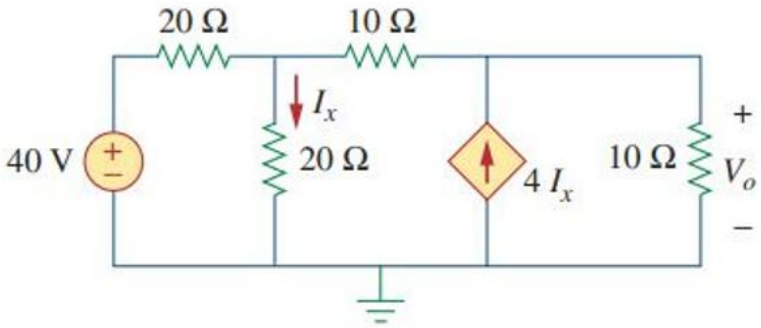
- **Find i**

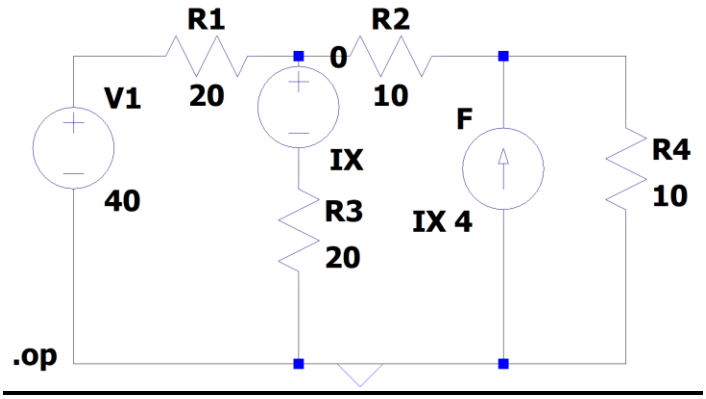




Current Controlled Current Source (CCCS):

- **Find Vo and Ix**





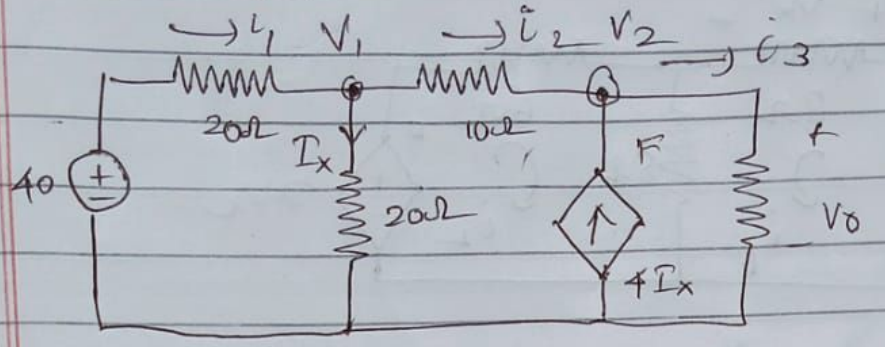
Hand Calculations:

Simulations Results:

Inference:

Results:

Current Controlled Current Source (CCCS)



$$i_1 = I_x + i_2$$

$$\frac{40 - V_1}{20} = \frac{V_1}{20} + \frac{V_1 - V_2}{10}$$

$$40 = 4V_1 - 2V_2 \quad -(1)$$

$$i_2 + 4I_x = i_3$$

$$\frac{V_1 - V_2}{10} + 4\frac{V_1}{20} = \frac{V_2}{10} \quad -(2)$$

$$3V_1 = 2V_2$$

$$I_x = \frac{V_1}{20}$$

$$V_0 = V_2$$

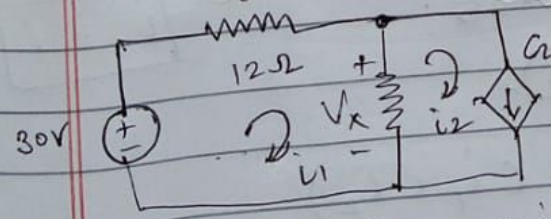
$\therefore V_1 = 40V$

$V_2 = 60V$

$\therefore I_x = 2A$

$V_0 = 60V$

Voltage Controlled Current Source (VCCS)



$$i_2 = 2V_x = 2(60i_1 - i_2)$$

$$\therefore V_x = 60(i_1 - i_2) = 120i_1 - 120i_2$$

at mesh (1) $\quad 30 = 12i_1 + 60(i_1 - i_2)$

Solution:

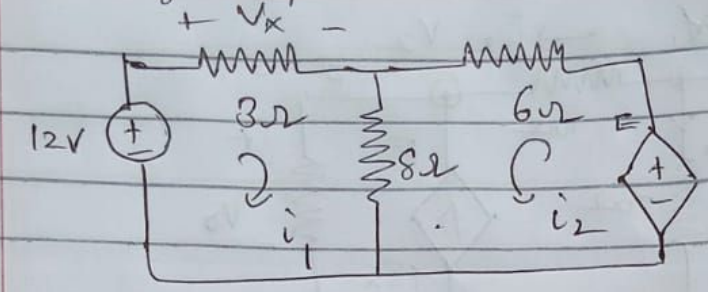
$i_2 = 2.38A$

$i_1 = 2.4A$

$V_x = 60(i_1 - i_2)$

$= 1.2V$

Voltage Dependent voltage Source (VCVS)



$3i_1 + 8(i_1 + i_2) = 12$

$2V_x = 6i_2 + 8(i_1 + i_2)$

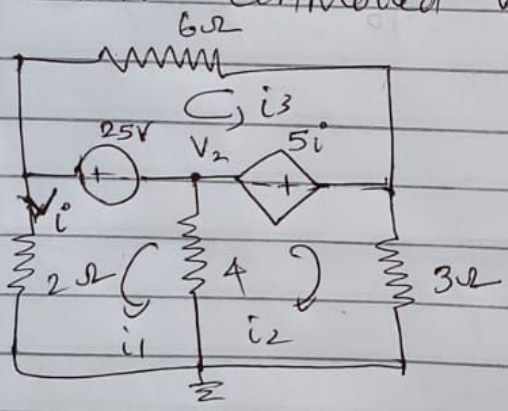
$V_x = 3i_1$

$i_2 = -0.1739\ A$

$i_1 = 1.2739\ A$

$V_x = 3.625\ V$

Current Controlled voltage Source (CCVS)



KVL around Mesh ①.

$-25 + 2i_1 + 4(i_1 + i_2) = 0$

$6i_1 + 4i_2 = 25$

$i_1 = i$

KVL around Mesh ②:

$5i = 3i_2 + 4(i_1 + i_2)$

$3i_2 + 4i_1 + 4i_2 = 5i$

$4i_1 + 7i_2 = 5i$ but $i = i_1$

$5i_1$

$-1i_1 + 7i_2 = 0$ — ②.

KVL around Mesh (3)

$$\therefore \quad 6i_3 + 25 - 5i_1 = 0$$

$$6i_3 - 5i_1 = -25 \quad (3)$$

$$-5i_1 + 6i_3 = -25 \quad (3)$$

6	4	0	25
−1	7	0	0
−5	0	6	−25

$i_1 = 3.8$

$i_2 = 0.54$

$i_3 = -0.996$

Current controlled voltage source $= 5 \times i_1$

$= 5 \times 3.8$

$= 19V$