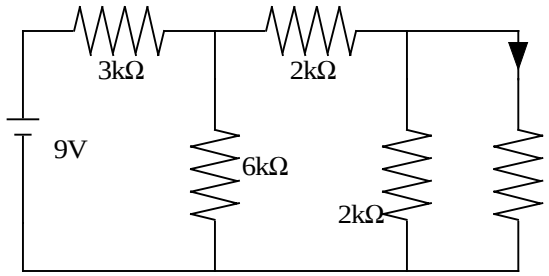
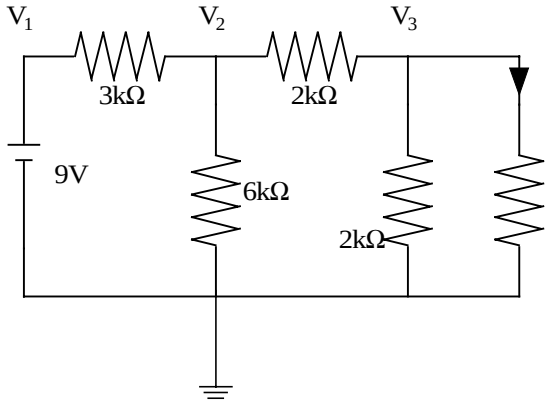
Problem 3.5

Find I_0 in the circuit using nodal analysis



Suggested Solution



$V_1 = 9V$

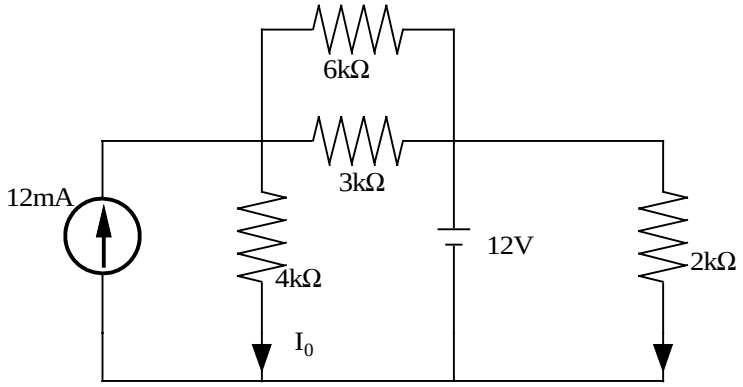
$$\frac{9-V_2}{3k} = \frac{V_2}{6k} + \frac{V_2 - V_3}{2k}$$

$$\frac{V_3 - V_2}{2k} + \frac{V_3}{2k} + \frac{V_3}{2k} = 0 \Rightarrow V_3 = 1.2V, I_0 = \frac{1.2}{2k} = 0.6mA$$

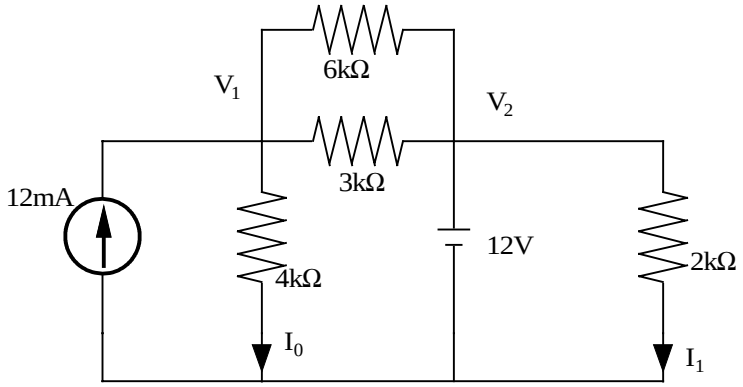
$V_3 = 1.2V$
$I_0 = 0.6mA$

Problem 3.10

Use nodal analysis to find out I_0 and I_1



Suggested Solution



$V_1 = -12V; I_1 = -6mA$

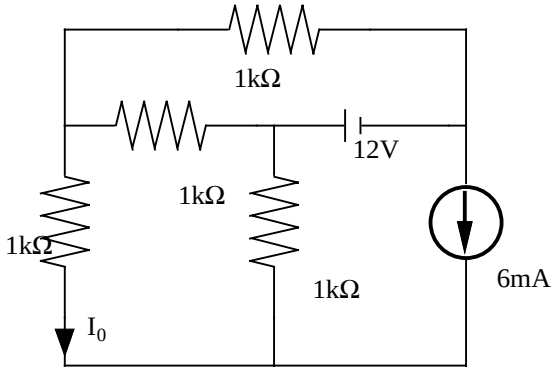
$\frac{12}{1K} + \frac{V_1}{4k} + \frac{V_1 - (-12)}{2k} = 0 \Rightarrow V_2 = -6V$

$V_1 = 8V; I_0 = 2mA$

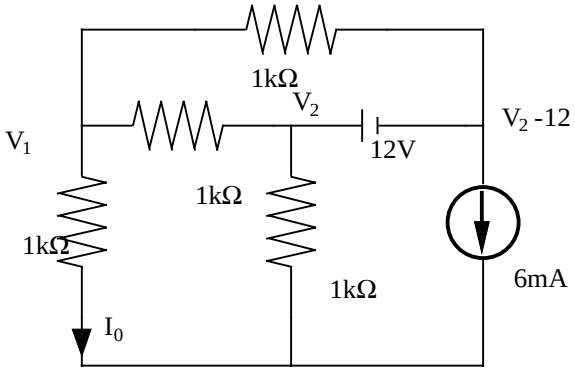
$\Rightarrow V_1 = 8V; I_0 = 2mA$

Problem 3.24

Find I_0 in the network shown.



Suggested Solution



$$\frac{V_1}{1k}+\frac{V_1-V_2}{1k}+\frac{V_1-(V_2-12)}{1k}=0$$

$$\frac{V_2-V_1}{1k}+\frac{V_2}{1k}+\frac{V_2-12-V_1}{1k}+\frac{6}{k}=0$$

$$\frac{3V_1}{1k}-\frac{2V_2}{1k}=\frac{-12}{1k};\frac{-2V_1}{1k}+\frac{3V_2}{1k}=\frac{6}{k}$$

$\Rightarrow$

$$3V_1-2V_2=-12$$

$$-2V_1+3V_2=6$$

$\Rightarrow$

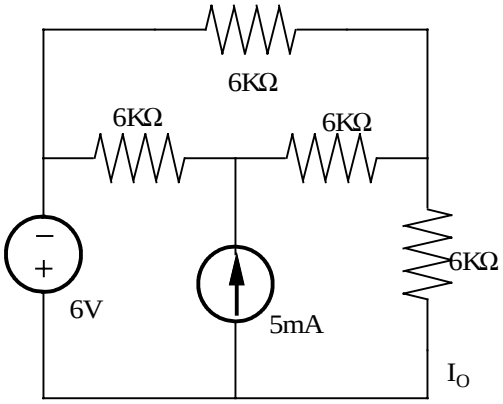
$$\begin{bmatrix}V_1\\V_2\end{bmatrix}=\begin{bmatrix}3&-2\\-2&3\end{bmatrix}\begin{bmatrix}-12\\6\end{bmatrix}=\begin{bmatrix}\frac{-24}{5}\\\frac{-6}{5}\end{bmatrix}$$

$$I_0=\frac{V_1}{1k}=\frac{\frac{-24}{5}}{1k}=-4.8mA$$

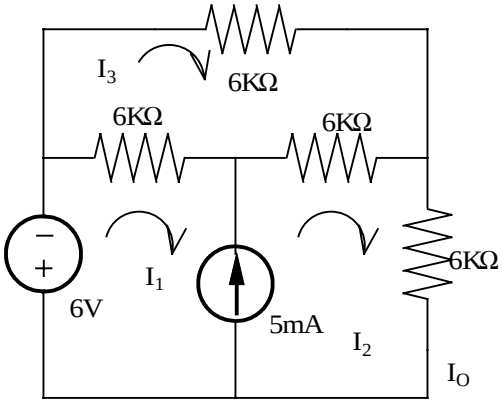
$I_0=-4.8mA$

Problem 3.53

Find Io in the network shown using loop analysis. Then solve the problem using matlab and compare your answers.



Suggested Solution



$$6 + 6K(I_1 - I_3) + +6K(I_2 - I_3) + 6KI_2 = 0$$

$$6KI_3 + 6K(I_3 - I_2) + 6K(I_3 - I_1) = 0$$

$$I_2 - I_1 = \frac{5}{K}$$

$$\begin{bmatrix} 6K & 12K & -12K \\ -6K & -6K & 18K \\ -1K & 1K & 0 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} -6 \\ 0 \\ 5 \end{bmatrix}$$

Using Matlab

```
EDU» Z=[6000 12000 -12000;-6000 -6000 18000;-1000 1000 0]

Z =

     6000    12000   -12000
    -6000    -6000    18000
    -1000     1000        0

EDU» V=[-6;0;5]

V =
```

-6
0
5

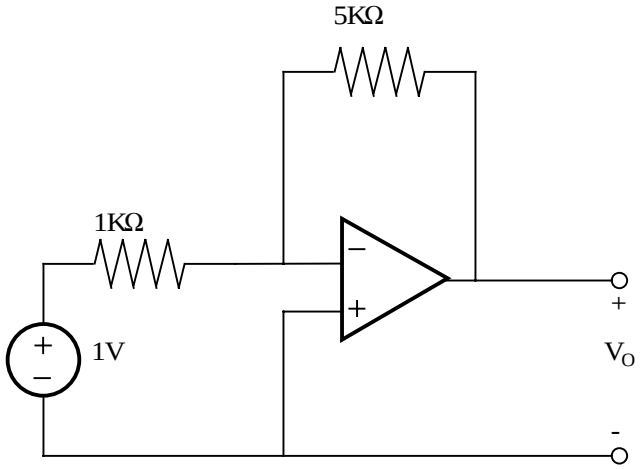
EDU» I=inv(Z)*V

I =

-0.0046
0.0004
-0.0014

Problem 3.70

Find Vo in the circuit shown.



Suggested Solution

KCL at the intersecting input

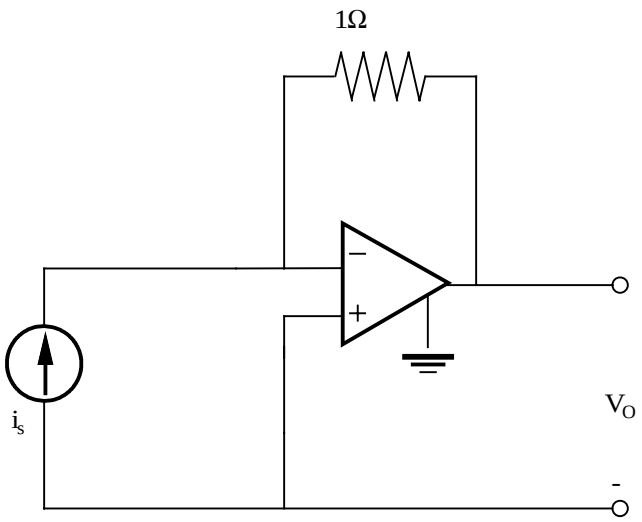
$$\frac{1\text{-}0}{0.1\text{K}} = \frac{0 - V0}{5K}$$

$$V0 = = -5V$$

$$V0 = = -5V$$

Problem 3.73

The network shown is a current-to-voltage converter or transresistance amplifier. Find Vo/Is for this network.



Suggested Solution

KCL at the inverting input is

$$\frac{5-4}{1}=\frac{0-V_0}{1}$$

$$\frac{V_0}{i_{s\ 0}}=-1$$

$$\frac{V_0}{i_{s\ 0}}=-1$$