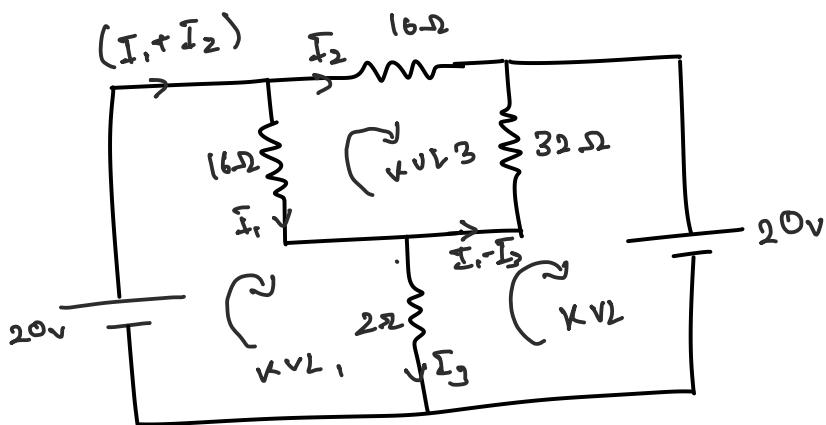


## # Case Study - 1

# Statement :

6	Electrical resistor network node voltage solver	23BME018
7	Use Kirchhoff current law to form linear equations for a multi node DC circuit and compute unknown voltages.	

# Circuit :



# For KV L-1 loop :

$$V \text{ across } 16\Omega \Rightarrow \underline{16 \times I_1}$$

$$\text{across } 2\Omega \Rightarrow \underline{2 \times I_3}$$

$$20V = 16I_1 + 2I_3 \quad \text{--- (1)}$$

# for KV L-2 loop :

$$V \text{ across } 32\Omega \Rightarrow \underline{(I_1 - I_3) \times 32}$$

$$\text{across } 2\Omega \Rightarrow \underline{(I_3) \times 2}$$

$$0 = 20 - 2I_3 - 32(I_1 - I_3)$$

$$20 = 2I_3 + 32(I_1 - I_3)$$

$$\left\{ 20 = 32I_1 - 30I_3 \right\} \quad \text{--- (2)}$$

# for  $\text{VL}^{-3}$  loop :

$$\begin{aligned} \text{V across } 16\Omega &= 16 \times I_1 \\ \text{across } 16\Omega &= 16 \times I_2 \\ \text{across } 32\Omega &= 32(I_1 - I_3) \end{aligned}$$

$$16I_1 + 16I_2 - 32(I_1 - I_3) = 0$$

$$\left[ 0 = I_1 - I_2 - 2I_3 \right] \quad \textcircled{3}$$

Equation form to be

$$\textcircled{1} \quad 16I_1 + 0I_2 + 2I_3 = 20$$

$$\textcircled{2} \quad 32I_1 + 0I_2 - 30I_3 = 20$$

$$\textcircled{3} \quad I_1 - I_2 - 2I_3 = 0$$

forming  $[A][x] = [B]$  matrix

$$\begin{bmatrix} 16 & 0 & 2 \\ 32 & 0 & -30 \\ 1 & -1 & -2 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 20 \\ 20 \\ 0 \end{bmatrix}$$

# Solving via matlab.

```

1 A = [16 0 2;32 0 -30;1 -1 -2];
2
3 B = [20;20;0];
4
5 X = A\B;
6
7 I1 = X(1)
8 I2 = X(2)
9 I3 = X(3)
10

```

Result via code:

```
I1 =  
1.1765  
  
I2 =  
0  
  
I3 =  
0.5882
```