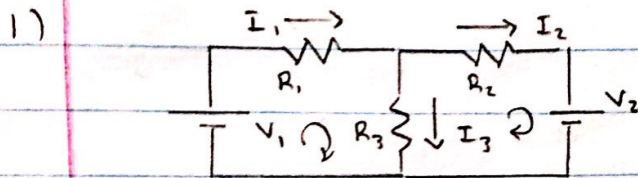


Computational Assignment 5

Exercise 1



Kirchhoff's Laws:

1) Sum of voltages around any loop = 0

2) Sum of currents @ any junction = 0

$$V_1 - I_1 R_1 - I_3 R_3 = 0$$

$$V_2 + I_2 R_2 - I_3 R_3 = 0$$

$$I_1 - I_2 - I_3 = 0$$

$$R_1 I_1 + 0 I_2 + R_3 I_3 = V_1$$

$$0 I_1 - R_2 I_2 + R_3 I_3 = V_2$$

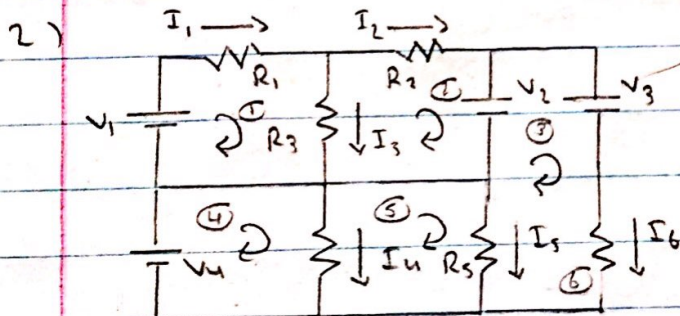
$$I_1 - I_2 - I_3 = 0$$

$$\Rightarrow \begin{bmatrix} R_1 & 0 & R_3 \\ 0 & -R_2 & R_3 \\ 1 & -1 & -1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \\ 0 \end{bmatrix}$$

reduces to this...

$$\Rightarrow \begin{bmatrix} R_1 I_1 + 0 I_2 + R_3 I_3 \\ 0 I_1 - R_2 I_2 + R_3 I_3 \\ I_1 - I_2 - I_3 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{aligned} R_1 I_1 + R_3 I_3 &= V_1 \\ -R_2 I_2 + R_3 I_3 &= V_2 \\ I_1 - I_2 - I_3 &= 0 \end{aligned}$$



$$1) V_1 - I_1 R_1 - I_3 R_3 = 0$$

$$V_2 + I_2 R_2 - I_3 R_3 = 0$$

$$V_3 + R_2 I_2 - R_3 I_3 - R_4 I_4 + R_6 I_6 = 0$$

$$V_4 + R_5 I_5 = 0$$

$$I_1 - I_2 - I_3 = 0$$

$$Mx = b \Rightarrow x = M^{-1}b$$

$$2) \begin{bmatrix} R_1 & 0 & R_3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -R_4 & 0 & 0 \\ 0 & -R_2 & R_3 & R_4 & 0 & -R_6 \\ 0 & -R_2 & R_3 & 0 & 0 & 0 \\ 1 & -1 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -R_5 & 0 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \\ I_6 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ 0 \\ V_4 \end{bmatrix}$$