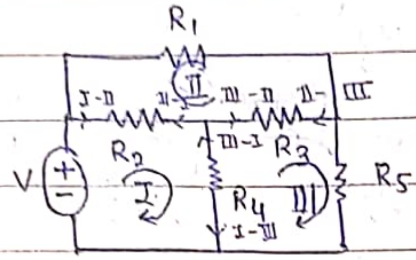
Q3 Problem Satement,

using kirchhoff's voltage law to derive set of equations for finding current for circuit. with the help of gauss-seidel method.

circuit,



given,

$R_1 = 6\,\Omega$ I $\Rightarrow i_1$

$R_2 = 4\,\Omega$ II $\Rightarrow i_2$

$R_3 = 8\,\Omega$ III $\Rightarrow i_3$

$R_4 = 2\,\Omega$

$R_5 = 5\,\Omega$

$V = 20V$

asumptions,

the system is ideal, and there is no energy loss in heat.

there is no resitance in wire.

$V = (i_1 - i_2)R_2 + (i_1 - i_3)R_4$ — for (I)

$0 = (i_3 - i_1)R_4 + (i_3 - i_2)R_3 + i_3 R_5$ — for (III)

$0 = (i_2 - i_3)R_3 + (i_2 - i_1)R_2 + i_2 R_1$ → for (II)

$$20 = 4i_1 - 4i_2 + 2i_1 - 2i_3$$

$$20 = 6i_1 - 4i_2 - 2i_3 \quad \text{—— I}$$

$$0 = 8i_2 - 8i_3 + 4i_2 - 4i_1 + 6i_2$$

$$0 = -4i_1 + 18i_2 - 8i_3 \quad \text{—— II}$$

$$0 = 2i_3 - 2i_1 + 8i_3 - 8i_2 + 5i_3$$

$$0 = -2i_1 - 8i_2 + 15i_3 \quad \text{—— III}$$

$$i_1 = \frac{1}{6}(20 + 4i_2 + 2i_3)$$

$$i_2 = \frac{1}{18}(4i_1 + 8i_3)$$

$$i_3 = \frac{1}{15}(2i_1 + 8i_2)$$

⇒ iteration initial $i_1^0 = 0$ $i_2^0 = 0$ $i_3^0 = 0$

$$i_1^1 = \frac{1}{6}(20+0+0) \qquad i_2^1 = \frac{1}{18}(4(i_1^1)+0) \qquad i_3^1 = \frac{1}{15}(2i_1^1 + 8i_2^1)$$

$$= \frac{1}{18}\left(4\left(\frac{20}{6}\right)\right) \qquad i = \frac{1}{15}\left(2i_1^1 + \frac{2 \times 8i}{9}\right.$$

⇒ II iteration.

$$i_1^2 = \frac{1}{6}(20 + 4i_2^1 + 2i_3^1)$$

$$i_2^2 = \frac{1}{18}(4i_1^2 + 8i_3^1)$$

$$i_3^2 = \frac{1}{15}(2i_1^2 + 8i_2^2)$$

$$\begin{bmatrix} 6 & -4 & -2 \\ -4 & 18 & -8 \\ -2 & -8 & 15 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 20 \\ 0 \\ 0 \end{bmatrix}$$

$i_1 \quad i_2 \quad i_3 \Rightarrow \quad 5 \; 2 \; 2$

$i_1 = 5.175879 \simeq 5$

$i_2 = 1.909547 \simeq 2$

$i_3 = 1.708542 \simeq 2$