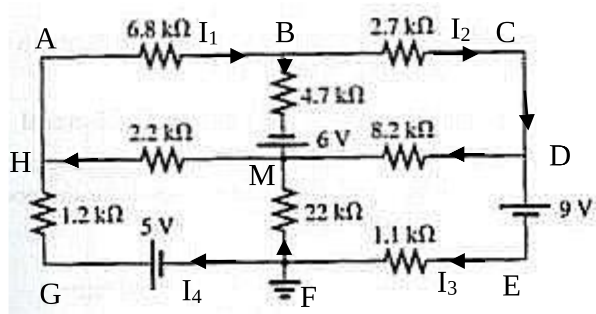
Q- Write the mesh equations for the network and solve for the loop currents.



The currents in different branches are indicated in the figure.

Applying current rule

At node B, the current form B to M will be $I_1 – I_2$

At node D, the current form D to M will be $I_2 – I_3$

At node F, the current form F to M will be $I_3 – I_4$

At node M, the current form M to H will be $I_1 – I_2 + I_2 – I_3 + I_3 – I_4 = I_1 – I_4$

Now applying loop rule

For mesh ABMH we get (clockwise positive)

$\Sigma E = \Sigma IR$

Or $6 = 6.8k\, I_1 + 4.7k\, (I_1 – I_2) + 2.2k\, (I_1 – I_4)$

Or $13.7k\, I_1 - 4.7k\, I_2 – 2.2k\, I_4 = 6$ ----------------------- (1)

For mesh BCDM we get (clockwise positive)

$\Sigma E = \Sigma IR$

Or $- 6 = 2.7k\, I_2 + 8.2k\, (I_2 – I_3) - 4.7k\, (I_1 – I_2)$

Or $-4.7k\, I_1 + 15.6k\, I_2 – 8.2k\, I_3 = - 6$

Or $4.7k\, I_1 - 15.6k\, I_2 + 8.2k\, I_3 = 6$ ----------------------- (2)

For mesh DEFM we get (clockwise positive)

$\Sigma E = \Sigma IR$

Or $-9 = 1.1k\, I_3 + 22k\, (I_3 – I_4) - 8.2k\, (I_2 – I_3)$

Or $- 8.2k\, I_2 + 31.3k\, I_3 - 22k\, I_4 = -9$

Or $8.2k\, I_2 - 31.3k\, I_3 + 22k\, I_4 = 9$ ----------------------- (3)

And for mesh HMFG we get (clockwise positive)

$\Sigma E = \Sigma IR$

Or $5 = 1.2k\, I_4 – 2.2k\, (I_1 – I_4) - 22k\, (I_3 – I_4)$

Or $- 2.2k\, I_1 - 22k\, I_3 + 25.4k\, I_4 = 5$

Or $2.2k\, I_1 + 22k\, I_3 - 25.4k\, I_4 = - 5$ ----------------------- (4)

Hence the equations to be solved are

$13.7k\ I_1 - 4.7k\ I_2 – 2.2k\ I_4 = 6$

$4.7k\ I_1 – 15.6k\ I_2 + 8.2k\ I_3 = 6$

$8.2k\ I_2 – 31.3k\ I_3 + 22k\ I_4 = 9$

$2.2k\ I_1 + 22k\ I_3 - 25.4k\ I_4 = - 5$

Using http://home.ubalt.edu/ntsbarsh/Business-stat/otherapplets/SysEq.htm

Gives

$I_1 = 0.032$ mA

$I_2 = - 0.884$ mA

$I_3 = - 0.968$ mA

$I_4 = - 0.639$ mA

(negative sign means that the direction of the current is opposite to that indicated in the circuit diagram.)