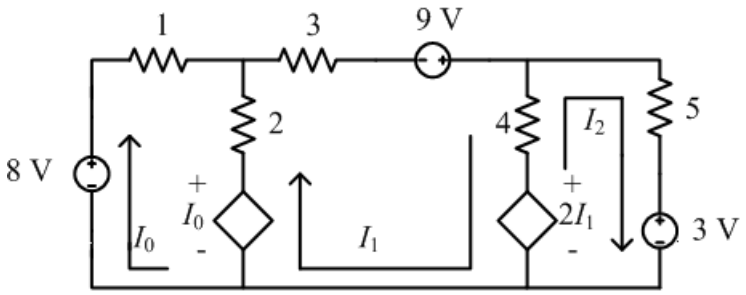
Mesh Analysis: Solutions to Exercise Problem
EP 1:
Obtain the loop currents in the circuit shown in Fig. 29. Verify your answer.



Resistors in Ohms

Fig. 29: Exercise Problem 1

"fig29EP1.gif"

Solution:

KVL equation for loop current I_0
$3.I_0 - 2.I_1 + I_0 - 8 = 0$, that is, $4.I_0 - 2.I_1 = 8$

KVL equation for loop current I_1
$9.I_1 - 2.I_0 - 4.I_2 + 2.I_1 - I_0 - 9 = 0$, that is, $-3.I_0 + 11.I_1 - 4.I_2 = 9$

KVL equation for loop current I_2
$9.I_2 + 3 - 2.I_1 - 4.I_1 = 0$, that is, $-6.I_1 + 9.I_2 = -3$

In matrix form,

$$\begin{pmatrix} 4 & -2 & 0 \\ -3 & 11 & -4 \\ 0 & -6 & 9 \end{pmatrix} \cdot \begin{pmatrix} I_0 \\ I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} 8 \\ 9 \\ -3 \end{pmatrix}$$

Let the resistance matrix be Z. Let the voltages be represented by a column vector V. Let loop currents be represented by a column vector, I.

$$Z := \begin{pmatrix} 4 & -2 & 0 \\ -3 & 11 & -4 \\ 0 & -6 & 9 \end{pmatrix} \qquad V := \begin{pmatrix} 8 \\ 9 \\ -3 \end{pmatrix}$$

$$I := Z^{-1} \cdot V \qquad I = \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} \quad A$$

$I_0 = 3$ A, $I_1 = 2$ A, $I_2 = 1$ A