A closed path or a loop is drawn by starting at a node and tracing a path such that we return to the original node without passing an intermediate node more than once.

A mesh is a special case of a loop. A mesh is a loop that does not contain any other loop within it.

Mesh analysis applies only to planar networks.

How many mesh currents are there?
There are 5 mesh currents.

* Each current $I_1$ to $I_5$ is assumed to circulate only around its specified mesh.

* Convention has it that mesh currents are assigned in a clockwise direction.

* The summation of voltages around any mesh is zero.
**MESH ANALYSIS**

**MESH EQUATIONS:**

\[-5 + 10 I_1 + 10 [I_1 - I_2] + 5 I_4 = 0\]
\[10 [I_3 - I_4] + 20 I_2 + 8 + 3 [I_2 - I_4] = 0\]
\[-8 + 6 I_3 - 3 + 5 [I_3 - I_5] = 0\]
\[2 I_4 + 3 [I_4 - I_2] + 10 [I_4 - I_5] + 8 I_4 = 0\]
\[5 I_5 + 10 [I_5 - I_4] + 5 [I_5 - I_3] + 5 I_5 = 0\]

\* WHEN SUMMING VOLTAGES AROUND MESH "C," THE MESH CURRENT \( I_C \) IS POSITIVE. 

CONSIDER MESH 1. THE "REAL" CURRENT IN THE 10 \unit{\Omega} RESISTOR BETWEEN MESH 1 AND 2 IS \([I_1 - I_2]\). 

WHEN SUMMING VOLTAGES AROUND MESH 2 THAT SAME CURRENT IS \([I_2 - I_1]\).
Simplify these 5 equations -
5 equations, 5 unknowns \([F_1 \text{ to } F_5]\)

\[
\begin{align*}
25F_1 - 10F_2 &= 5 \\
-10F_1 + 33F_2 - 3F_4 &= -8 \\
11F_3 - 5F_5 &= 11 \\
-3\frac{F_1}{2} + 23F_4 - 10F_5 &= 0 \\
-5\frac{F_3}{3} - 10F_4 + 25F_5 &= 0
\end{align*}
\]

\[
\begin{bmatrix}
25 & -10 & 0 & 0 & 0 \\
-10 & 33 & 0 & -3 & 0 \\
0 & 0 & 11 & 0 & -5 \\
0 & -3 & 0 & 23 & -10 \\
0 & 0 & -5 & -10 & 25
\end{bmatrix}
\begin{bmatrix}
F_1 \\
F_2 \\
F_3 \\
F_4 \\
F_5
\end{bmatrix}
= 
\begin{bmatrix}
5 \\
-8 \\
11 \\
0
\end{bmatrix}
\]

\[F_1 = 0.121 \text{ A}\]

\[F_2 = -0.198 \text{ A}\]

\[F_3 = 1.117 \text{ A}\]

\[F_4 = 0.084 \text{ A}\]

\[F_5 = 0.258 \text{ A}\]