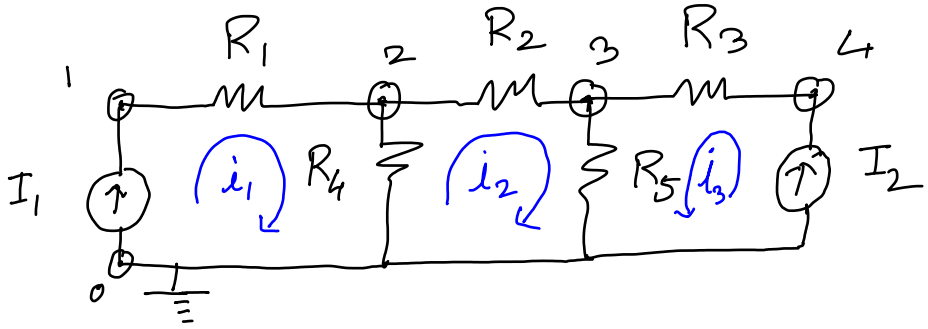
Quick Recap

"b" → no. of branches
"n" → no. of nodes

$(n-1)$ variables to do node analysis

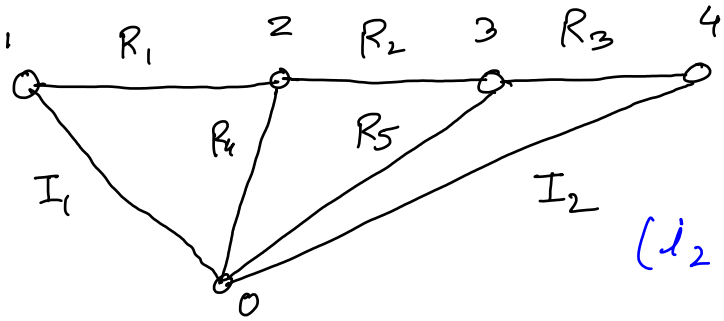
$(b-n+1)$ variables to do loop analysis



(circuit)

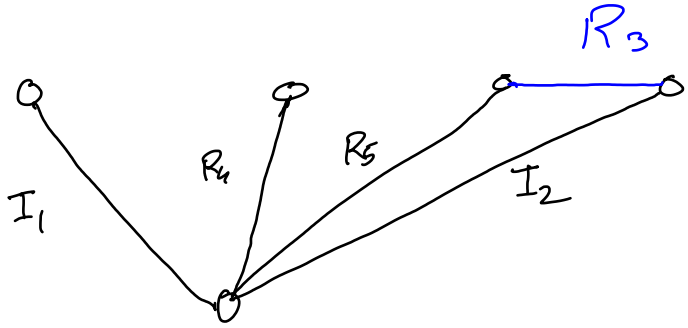
$i_1 = I_1$

$i_3 = I_2$

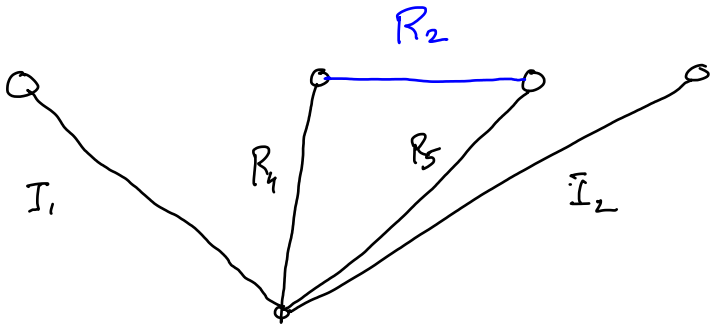


(graph)

$(i_2 - i_1) R_4 + i_2 R_2 + (i_2 + i_3) R_5 = 0$



(tree)

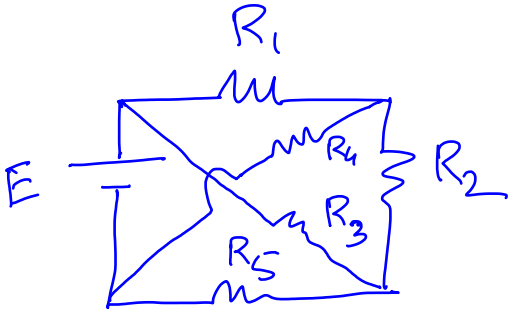


Mesh → a loop which does not contain any other loop.

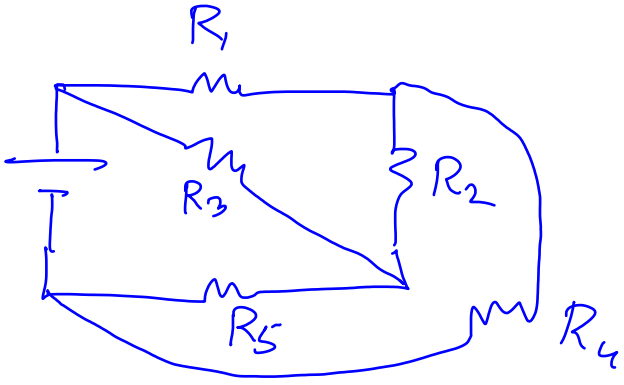
Loops → 6

Meshs → 3

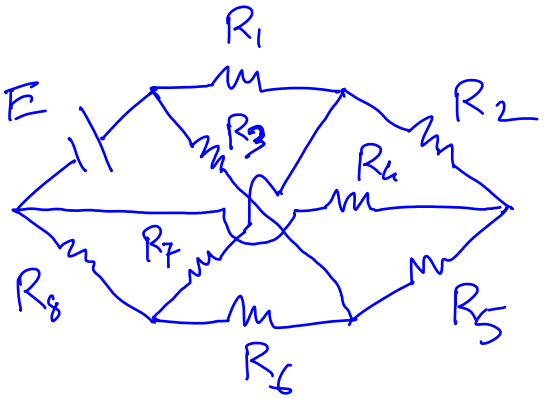
For planar circuits, use Mesh currents as independent variables --



⇒

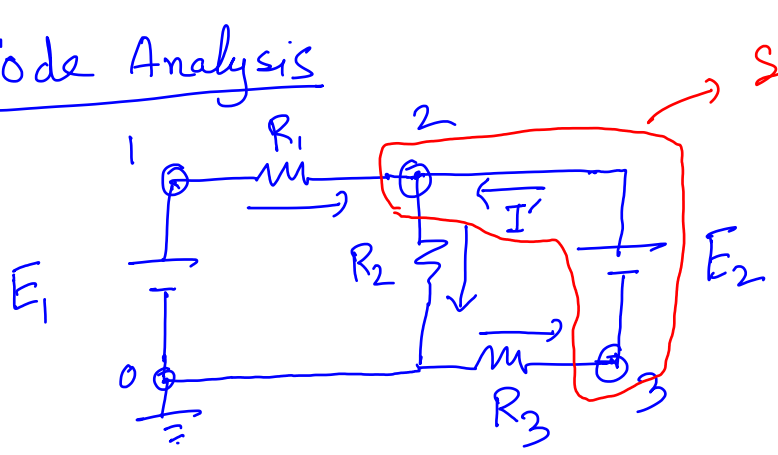


(planar)



(non-planar)

Node Analysis



V_1, V_2, V_3

$V_1 = E_1$

$V_2 - V_3 = E_2$

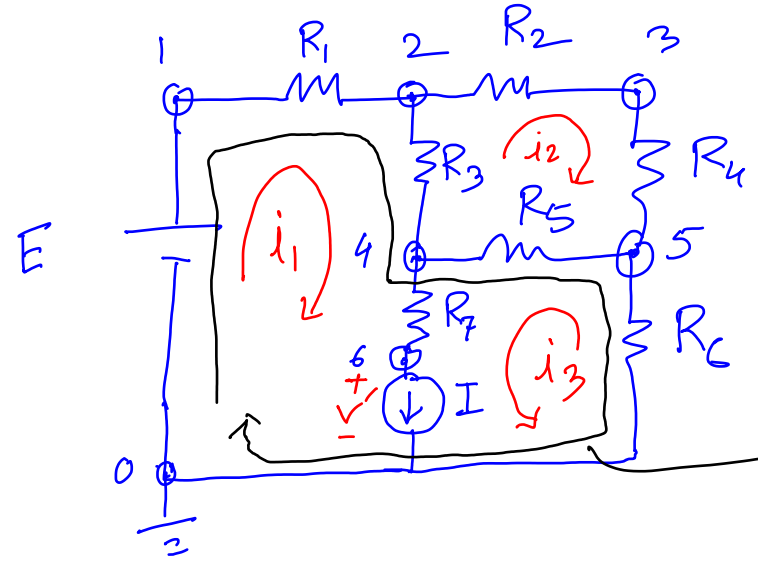
$$\frac{V_1 - V_2}{R_1} + I' = \frac{V_2}{R_2}$$

$$-\frac{V_3}{R_3} = I'$$

} Combine

$$\frac{V_1 - V_2}{R_1} - \frac{V_3}{R_3} = \frac{V_2}{R_2}$$ — (eqn. using super-node)

Mesh Analysis



$b = 9$

$n = 7$

$b - n + 1 = 3$

(Super Mesh)

KVL will lead to eqn. (5).

KVL at Mesh 1,

$$E = i_1 R_1 + (i_1 - i_2) R_3 + (i_1 + i_3) R_7 + V' \quad \text{— (1)}$$

$$(i_2 - i_1) R_3 + i_2 R_2 + i_2 R_4 + (i_2 + i_3) R_5 = 0 \quad \text{— (2)}$$

$$(i_3 + i_1) R_2 + V' + i_3 R_6 + (i_3 + i_2) R_5 = 0$$

—— (3)

Adding (1) and (3),

$$E + i_3 R_6 + (i_3 + i_2) R_5 = i_1 R_1 + (i_1 - i_2) R_3$$

→ (5)

$$i_1 + i_3 = I \quad \text{——} \quad (4)$$

Use (2), (4) and (5) to solve for i_1, i_2 and i_3.