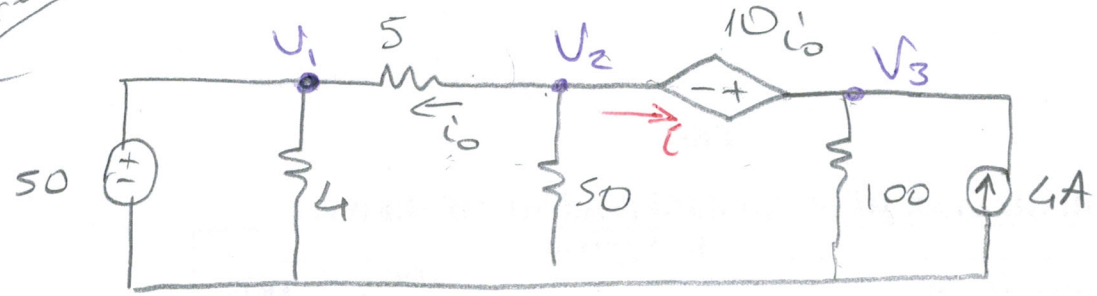
Örnek

$V = \frac{i_0}{5}$

9-1



$i_0 = ?$

düğüm 1 $\Rightarrow$ $V_1 = 50V$

düğüm 2 $\Rightarrow$ $\frac{V_2 - V_1}{5} + \frac{V_2}{50} + i = 0$

düğüm 3 $\Rightarrow$ $\frac{V_3}{100} - 4 - i = 0$

$\Rightarrow$

$$\frac{V_2 - V_1}{5} + \frac{V_2}{50} + \frac{V_3}{100} - 4 = 0$$

$$\frac{V_2 - 50}{5} + \frac{V_2}{50} + \frac{V_3}{100} = 4$$

$$20V_2 - 1000 + 2V_2 + V_3 = 400$$

$$22V_2 + V_3 = 1400$$

$\Rightarrow$ $\frac{V_2 - V_1}{5} = i_0$, $V_3 - V_2 = 10i_0$ $\Rightarrow$ $\frac{V_2 - 50}{5} = \frac{V_3 - V_2}{10}$

$$2V_2 - 100 = V_3 - V_2$$

$$3V_2 - V_3 = 100$$

$\Rightarrow$ $22V_2 + V_3 = 1400$

$3V_2 - V_3 = 100$

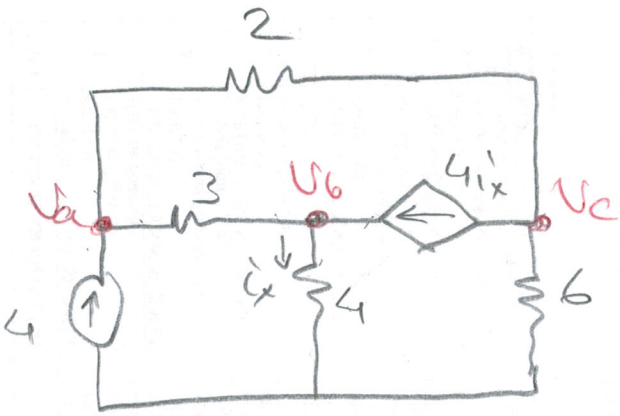
$25V_2 = 1500$

$V_2 = 60V$

$V_3 = 80V$

$i_0 = \frac{80 - 60}{10} = 2A$

Örnek



Node analizi ile inceleyelim

Düğüm a: $\Rightarrow \quad -4 + \frac{V_a - V_c}{2} + \frac{V_a - V_b}{3} = 0 \quad \cdots \quad (1)$

Düğüm b $\Rightarrow \quad \frac{V_b - V_a}{3} + \frac{V_b}{4} - 4i_x = 0 \quad -- \quad (2)$

Düğüm c $\Rightarrow \quad \frac{V_c}{6} + 4i_x + \frac{V_c - V_a}{2} = 0 \quad -- \quad (3)$

$$i_x = \frac{V_b}{4}$$

$(1) \rightarrow \quad -24 + 3V_a - 3V_c + 2V_a - 2V_b = 0$

$$5V_a - 2V_b - 3V_c = 24$$

$(2) \rightarrow \quad 4V_b - 4V_a + 3V_b - 12V_b = 0$

$$-4V_a - 5V_b = 0 \rightarrow V_a = -\frac{5V_b}{4}$$

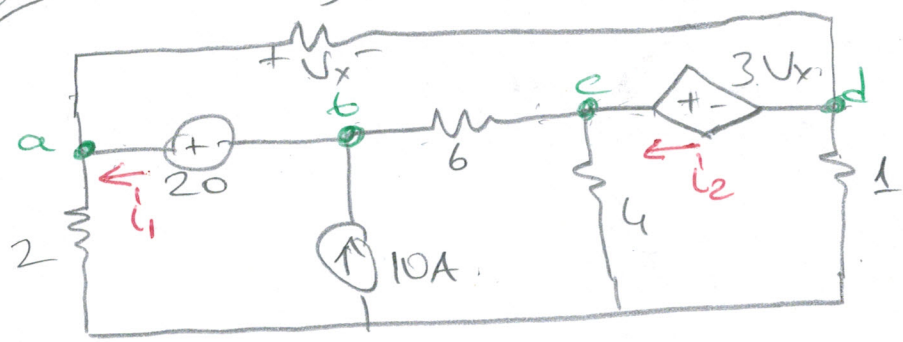
$(3) \rightarrow \quad V_c + 6V_b + 3V_c - 3V_a = 0$

$$-3V_a + 6V_b + 4V_c = 0$$

$$V_a = 32V \qquad V_b = 25,6V$$

$$V_c = 62,4V$$

Örnek



Devredeki düğüm gerilimlerini bulun.

Düğüm a => $\frac{V_a}{2} + \frac{V_a - V_d}{3} - i_1 = 0$

Düğüm b => $-10 + i_1 + \frac{V_b - V_c}{6} = 0$

$$+$$

$$① \cdots \frac{V_a}{2} + \frac{V_a - V_d}{3} - 10 + \frac{V_b - V_c}{6} = 0$$

Düğüm c => $-i_2 + \frac{V_c}{4} + \frac{V_c - V_b}{6} = 0$

Düğüm d => $\frac{V_d}{1} + i_2 + \frac{V_d - V_a}{3} = 0$

$$+$$

$$② \cdots \frac{V_c}{4} + \frac{V_c - V_b}{6} + V_d + \frac{V_d - V_a}{3} = 0$$

① → $3V_a + 2V_a - 2V_d + V_b - V_c = 60$

$5V_a + V_b - V_c - 2V_d = 60$

② → $3V_c + 2V_c - 2V_b + 12V_d + 4V_d - 4V_a = 0$

$-4V_a - 2V_b + 5V_c + 16V_d = 0$

$V_a - V_d = V_x$ ③

$V_c - V_d = 3V_x$ ④

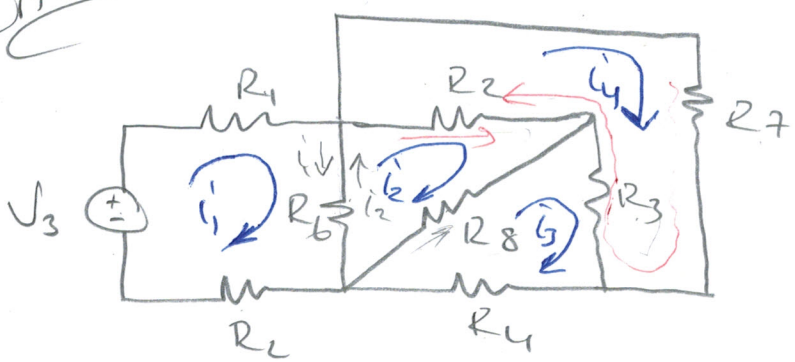
$V_a - V_b = 20$ ⑤

$V_a = 26,67V$ $V_b = ?$ $V_c = 173,33V$ $V_d = -46,67$

3.2) Mesh Current Analysis – Göz Analizi

Göz analizinde bilinmeyen akımları bulmak için KVL kullanılır.

Örnek



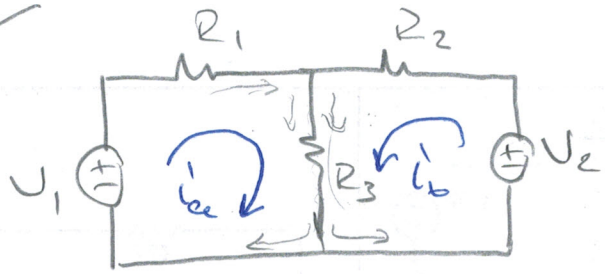
Göz 1 => $-V_3 + R_1 i_1 + R_6 (i_1 - i_2) + i_1 R_2 = 0$

Göz 2 => $(i_2 - i_1) R_6 + (i_2 - i_4) R_2 + (i_2 - i_3) R_8 = 0$

Göz 3 => $R_4 . i_3 + (i_3 - i_2) R_8 + (i_3 - i_4) . R_3 = 0$

Göz 4 => $R_7 . i_4 + (i_4 - i_3) R_3 + (i_4 - i_2) . R_2 = 0$

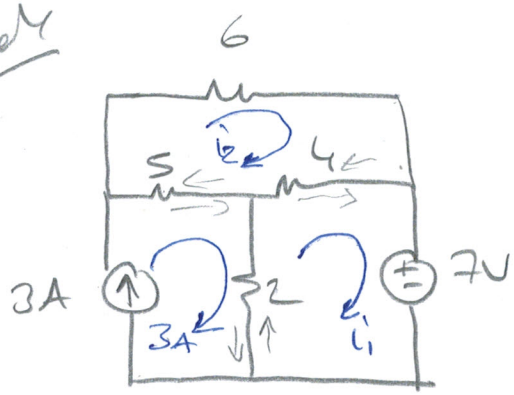
Örnek



$-V_1 + R_1 i_a + (i_a + i_b) R_3 = 0$

$-V_2 + R_2 . i_b + (i_a + i_b) . R_3 = 0$

Ömer



$$7 + (i_1 - 3)\cdot 2 + (i_1 - i_2)\cdot 4 = 0$$

$$2i_1 - 6 + 4i_1 - 4i_2 = -7$$

$$6i_1 - 4i_2 = -1$$

$$6i_2 + 4(i_2 - i_1) + 5(i_2 - 3) = 0$$

$$6i_2 + 4i_2 - 4i_1 + 5i_2 - 15 = 0$$

$$-4i_1 + 15i_2 = 15$$

$$4 / \; 6i_1 - 4i_2 = -1$$

$$6 / \; -4i_1 + 15i_2 = 15 \quad \Rightarrow$$

$$24i_1 - 16i_2 = -4$$

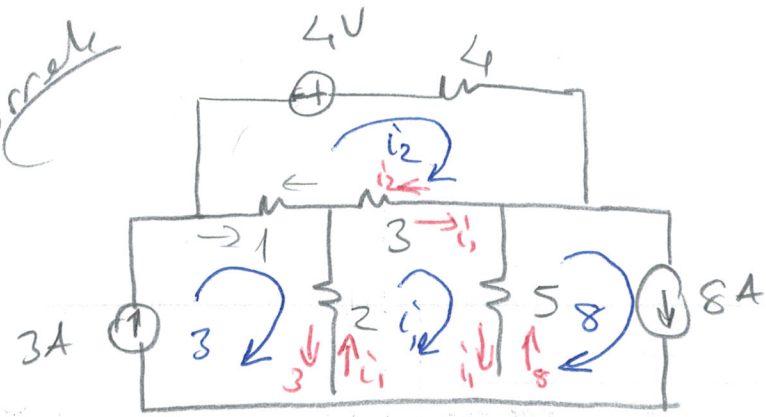
$$-24i_1 + 90i_2 = 90$$

$$74i_2 = 86$$

$$i_2 = 1{,}16\,A$$

$$i_1 = 0{,}6\,A$$

Ömer



$$2(i_1 - 3) + 3(i_1 - i_2) + 5\cdot(i_1 - 8) = 0$$

$$-4 + 4i_2 + 3(i_2 - i_1) + 1(i_2 - 3) = 0$$

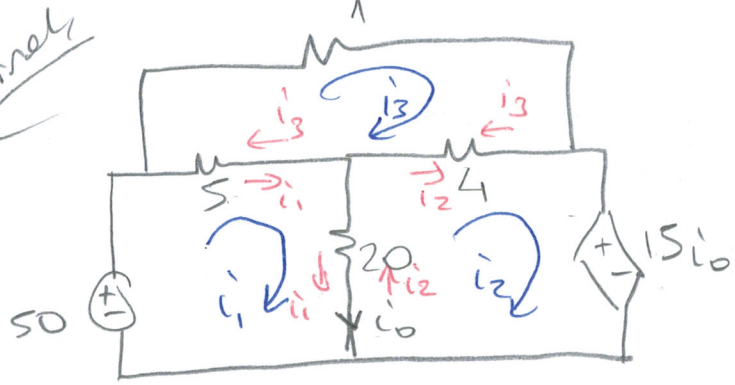
$$2i_1 - 6 + 3i_1 - 3i_2 + 5i_1 = 40$$

$$10i_1 - 3i_2 = 46$$

$$4i_2 + 3i_2 - 3i_1 + i_2 = 7 \quad \longrightarrow$$

$$-3i_1 + 8i_2 = 7$$

Örnek



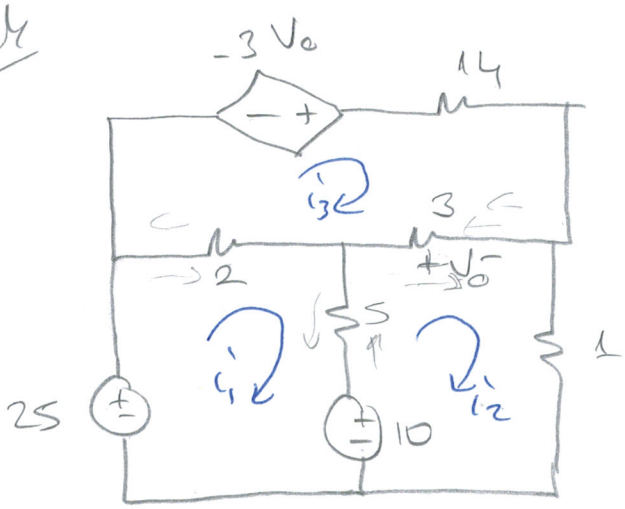
Göz 1 => $-50 + 5(i_1 - i_3) + 20(i_1 - i_2) = 0$

Göz 2 => $-15 i_o + 20(i_2 - i_1) + 4(i_2 - i_3) = 0$

Göz 3 => $1 i_3 + 4(i_3 - i_2) + 5(i_3 - i_1) = 0$

$i_o = i_1 - i_2$

Örnek



$-25 + 2(i_1 - i_3) + 5(i_1 - i_2) + 10 = 0$

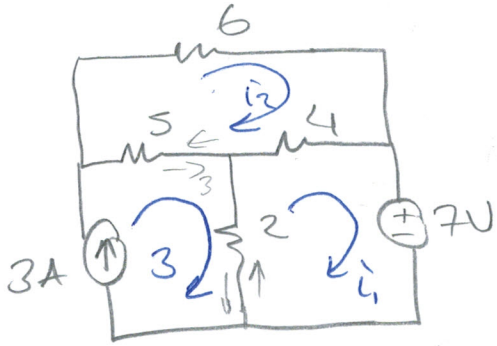
$-10 + 5(i_2 - i_1) + 3(i_2 - i_3) + 1 i_2 = 0$

$-(-3V_o) + 14 i_3 + 3(i_3 - i_2) + 2(i_3 - i_1) = 0$

$U = I R$

$V_o = 3 \cdot (i_2 - i_3)$

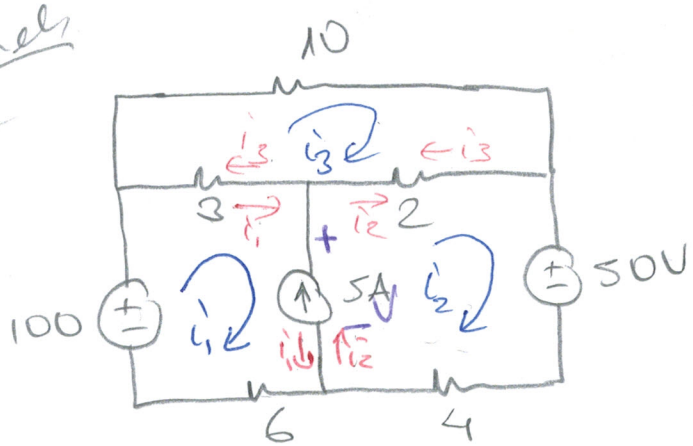
Örnek



$$7 + 2(i_1 - 3) + 4(i_1 - i_2) = 0$$

$$6i_2 + 4(i_2 - i_1) + 5(i_2 - 3) = 0$$

Örnek



- $-100 + 3(i_1 - i_3) + V + 6i_1 = 0$
- $50 + 4i_2 - V + 2(i_2 - i_3) = 0$

$$-50 + 3i_1 - 3i_3 + 6i_1 + 4i_2 + 2i_2 - 2i_3 =$$

$$9i_1 + 6i_2 - 5i_3 = 50$$

- $10i_3 + 2(i_3 - i_2) + 3(i_3 - i_1) = 0$

$$10i_3 + 2i_3 - 2i_2 + 3i_3 - 3i_1 = 0$$

$$-3i_1 - 2i_2 + 15i_3 = 0$$

$$i_2' - i_1' = 5$$

$$\Rightarrow i_2' = 5 + i_1'$$