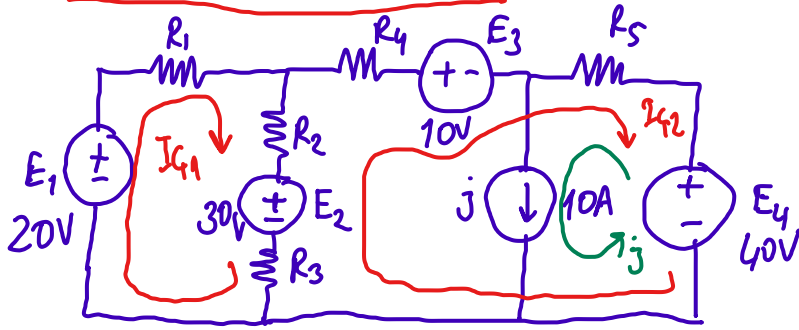


Çevre Akımları Yöntemi (Gözümlü Örnek) Doç. Dr. Recep Yumurtacı (YTÜ)



$$R_1 = R_2 = R_3 = R_4 = R_5 = 2\Omega$$

(1)/9

a) ÇAY ile devre denklemlerini matris biçiminde elde ediniz.

b) $P_{R_3} = ?$

c) $P_{E_4} = ?$

Gözüm

a) I_{G1} çevresi için çevre denklemi

$$-E_1 + (R_1 + R_2 + R_3) \cdot I_{G1} - (R_2 + R_3) \cdot I_{G2} + E_2 = 0$$

$$(R_1 + R_2 + R_3) \cdot I_{G1} - (R_2 + R_3) \cdot I_{G2} - E_1 + E_2 = 0$$

I_{G2} çevresi için çevre denklemi

$$(R_2 + R_3 + R_4 + R_5) I_{G2} - (R_2 + R_3) \cdot I_{G1} - E_2 + E_3 + E_4 - R_5 \cdot j = 0$$

$$-(R_2 + R_3) \cdot I_{G1} + (R_2 + R_3 + R_4 + R_5) \cdot I_{G2} - E_2 + E_3 + E_4 - R_5 \cdot j = 0$$

$$\begin{bmatrix} (R_1 + R_2 + R_3) & -(R_2 + R_3) \\ -(R_2 + R_3) & (R_2 + R_3 + R_4 + R_5) \end{bmatrix} \begin{bmatrix} I_{G1} \\ I_{G2} \end{bmatrix} + \begin{bmatrix} -1 & 1 & 0 & 0 \\ 0 & -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} E_1 \\ E_2 \\ E_3 \\ E_4 \end{bmatrix} + \begin{bmatrix} 0 \\ -R_5 \end{bmatrix} \cdot j = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

b) $E_1 = 20V, E_2 = 30V, E_3 = 10V, E_4 = 40V, j = 10A, R_1 = R_2 = \dots = R_5 = 2\Omega$

$$\begin{bmatrix} 6 & -4 \\ -4 & 8 \end{bmatrix} \begin{bmatrix} I_{G1} \\ I_{G2} \end{bmatrix} + \begin{bmatrix} -1 & 1 & 0 & 0 \\ 0 & -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 20 \\ 30 \\ 10 \\ 40 \end{bmatrix} + \begin{bmatrix} 0 \\ -2 \end{bmatrix} \cdot 10 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

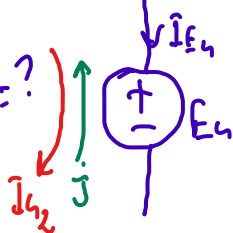
$$\begin{bmatrix} 6 & -4 \\ -4 & 8 \end{bmatrix} \begin{bmatrix} I_{G1} \\ I_{G2} \end{bmatrix} + \begin{bmatrix} -20 + 30 \\ -30 + 10 + 40 \end{bmatrix} + \begin{bmatrix} 0 \\ -20 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 6 & -4 \\ -4 & 8 \end{bmatrix} \begin{bmatrix} I_{G1} \\ I_{G2} \end{bmatrix} = \begin{bmatrix} -10 \\ 0 \end{bmatrix} \Rightarrow \Delta = \begin{vmatrix} 6 & -4 \\ -4 & 8 \end{vmatrix} = 6 \cdot 8 - (-4) \cdot (-4) = 32$$

$$I_{G1} = \frac{\begin{vmatrix} -10 & -4 \\ 0 & 8 \end{vmatrix}}{\begin{vmatrix} 6 & -4 \\ -4 & 8 \end{vmatrix}} = \frac{-80}{32} \Rightarrow I_{G1} = -2,5A \quad I_{G2} = \frac{\begin{vmatrix} 6 & 10 \\ -4 & 0 \end{vmatrix}}{\begin{vmatrix} 6 & -4 \\ -4 & 8 \end{vmatrix}} = \frac{40}{32} \Rightarrow I_{G2} = 1,25A$$

$$I_{R_3} = I_{G2} - I_{G1} = 1,25 - (-2,5) = 3,75A \Rightarrow P_{R_3} = R_3 \cdot I_{R_3}^2 = 2 \cdot 3,75^2 \Rightarrow P_{R_3} = 28,125W$$

$$P_{E_4} = E_4 \cdot I_{E_4} \Rightarrow I_{E_4} = ? \quad I_{E_4} = I_{G2} - j = 1,25 - 10 = -8,75A$$



$$P_{E_4} = E_4 \cdot I_{E_4} = 40 \cdot (-8,75) \Rightarrow P_{E_4} = -350W$$