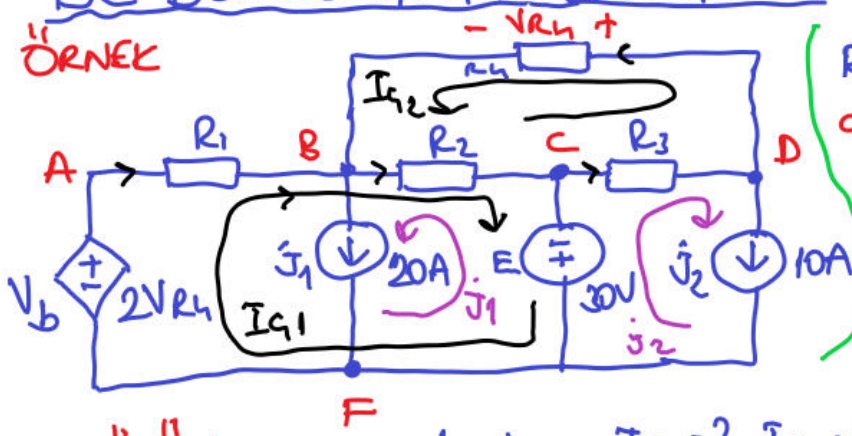


DC Devrede GAY ile devre çözümü

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1

ÖRNEK



$$R_1 = R_2 = R_3 = R_4 = 1\Omega$$

a) GAY ile devre denklemlerini adım-adım elde ediniz ve matris biçiminde yazınız

b) Denklemleri çözünüz.

$$P_{R_2} = ?, P_{J_1} = ?$$

ÇÖZÜM

Gevre akımları: $I_{L_1} = ?$, $I_{L_2} = ?$

Direnç akımlarını gevre akımları cinsinden yazalım:

$$I_{R_1} = I_{L_1}, I_{R_2} = I_{L_1} + I_{L_2} - \hat{J}_1, I_{R_3} = I_{L_2} + \hat{J}_2, I_{R_4} = I_{L_2}$$

$$V_b = 2V_{R_4} = 2R_4 I_{R_4} = 2R_4 I_{L_2} \Rightarrow V_b = 2R_4 I_{L_2}$$

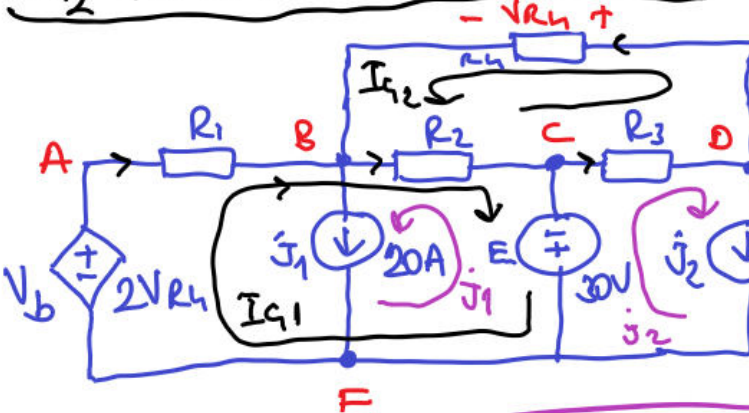
I_{L_1} gevesi için gevre denklemini

$$-V_b + R_1 I_{L_1} + R_2 I_{L_2} - E = 0$$

$$-2R_4 I_{L_2} + R_1 I_{L_1} + R_2 (I_{L_1} + I_{L_2} - \hat{J}_1) - E = 0$$

$$(R_1 + R_2) I_{L_1} + (R_2 - 2R_4) I_{L_2} - E - R_2 \hat{J}_1 = 0 \quad 1. \text{ denklemin}$$

I_{L_2} gevesi için gevre denklemini



$$R_4 I_{R_4} + R_2 I_{R_2} + R_3 I_{R_3} = 0$$

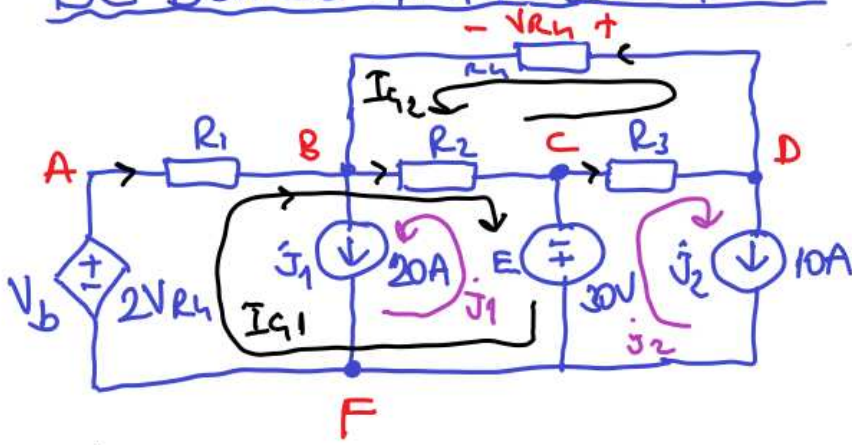
$$R_4 I_{L_2} + R_2 (I_{L_1} + I_{L_2} - \hat{J}_1) + R_3 (I_{L_2} + \hat{J}_2) = 0$$

$$R_2 I_{L_1} + (R_2 + R_3 + R_4) I_{L_2} - R_2 \hat{J}_1 + R_3 \hat{J}_2 = 0 \quad 2. \text{ denklemin}$$

Denklemleri Matris Biçiminde Yazalım:

$$\begin{bmatrix} (R_1 + R_2) & (R_2 - 2R_4) \\ R_2 & (R_2 + R_3 + R_4) \end{bmatrix} \begin{bmatrix} I_{L_1} \\ I_{L_2} \end{bmatrix} + \begin{bmatrix} -1 \\ 0 \end{bmatrix} E + \begin{bmatrix} -R_2 & 0 \\ -R_2 & R_3 \end{bmatrix} \begin{bmatrix} \hat{J}_1 \\ \hat{J}_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$b) \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} I_{L_1} \\ I_{L_2} \end{bmatrix} + \begin{bmatrix} -1 \\ 0 \end{bmatrix} \cdot 30 + \begin{bmatrix} -1 & 0 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 20 \\ 10 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} I_{L_1} \\ I_{L_2} \end{bmatrix} = \begin{bmatrix} 50 \\ 100 \end{bmatrix}$$



$$\begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} I_{q1} \\ I_{q2} \end{bmatrix} = \begin{bmatrix} 50 \\ 10 \end{bmatrix}$$

$$I_{q1} = \frac{\begin{vmatrix} 50 & -1 \\ 10 & 3 \end{vmatrix}}{\begin{vmatrix} 2 & -1 \\ 1 & 3 \end{vmatrix}} = \frac{160}{7} = 22,857A$$

$$I_{q2} = \frac{\begin{vmatrix} 2 & 50 \\ 1 & 10 \end{vmatrix}}{\begin{vmatrix} 2 & -1 \\ 1 & 3 \end{vmatrix}} = \frac{-30}{7} = -4,286A$$

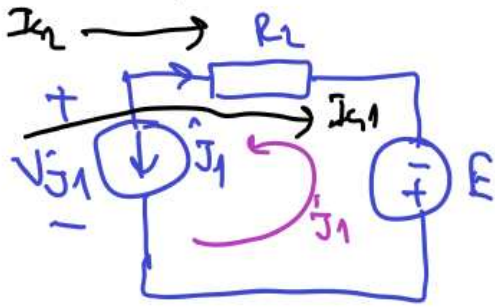
İstenenler

1) $P_{R2} = ?$ $P_{R2} = R_2 I_{R2}^2 \Rightarrow I_{R2} = I_{q1} + I_{q2} - \hat{J}_1 = 22,857 - 4,286 - 20$

$I_{R2} = -1,429A \Rightarrow P_{R2} = R_2 \cdot I_{R2}^2 = 1 \cdot 1,429^2 \Rightarrow \boxed{P_{R2} = 2,042W}$

2) $P_{\hat{J}_1} = ?$

$P_{\hat{J}_1} = V_{\hat{J}_1} \cdot \hat{J}_1 \Rightarrow \hat{J}_1 = 20A$ $V_{\hat{J}_1} = ?$ ($V_{\hat{J}_1}$ 'i bulmak için $\hat{J}_1$ 'in olduğu bir çevre seçilerek yazılıyor)



$$V_{\hat{J}_1} + E - V_{R2} = 0 \Rightarrow V_{\hat{J}_1} = V_{R2} - E = R_2 I_{R2} - E$$

$$I_{R2} = I_{q1} + I_{q2} - \hat{J}_1 = -1,429A$$

$$V_{\hat{J}_1} = R_2 I_{R2} - E = 1 \cdot (-1,429) - 30$$

$$\boxed{V_{\hat{J}_1} = -31,429V}$$

$P_{\hat{J}_1} = V_{\hat{J}_1} \cdot \hat{J}_1 = (-31,429) \cdot 20 \Rightarrow \boxed{P_{\hat{J}_1} = -628,58W}$