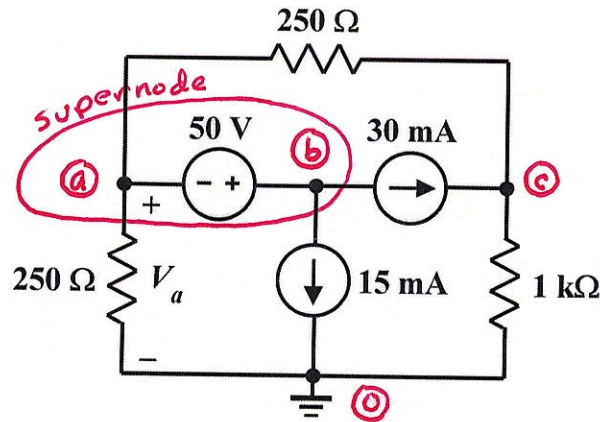


Homework Problem 015

Use the nodal analysis method to write nodal equations and express them in the matrix form discussed in class. Then solve the equations to determine V_a .



$$V_b - V_a = 50 \text{ V} \quad (\text{constraint equation for the supernode})$$

$$\frac{V_a - V_c}{250 \Omega} + 30 \text{ mA} + 15 \text{ mA} + \frac{V_a}{250 \Omega} = 0 \quad (\text{KCL for the supernode})$$

$$\frac{V_c - V_a}{250 \Omega} - 30 \text{ mA} + \frac{V_c}{1 \text{ k}\Omega} = 0 \quad (\text{KCL for node c})$$

In matrix form:

$$\begin{bmatrix} -1 & 1 & 0 \\ 1/250 & 0 & -1/250 \\ -1/250 & 0 & 1/200 \end{bmatrix} \begin{bmatrix} V_a \\ V_b \\ V_c \end{bmatrix} = \begin{bmatrix} 50 \\ -0.045 \\ 0.030 \end{bmatrix}$$

Solving yields:

$$V_a = -4.375 \text{ V}$$