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which can be written as

$$[R][i] = [v]$$

with solution

$$[i] = [R]^{-1}[v]$$

4. Solve the linear system of $n - m$ unknowns. The system of equations is

$$\begin{bmatrix} 1.5 & -0.5 & 0 \\ -1.5 & 2 & -0.25 \\ 1 & -1.25 & 0.5 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} v_1 \\ 0 \\ 0 \end{bmatrix}$$

Thus, to solve for the unknown mesh currents, we must compute the inverse of the matrix of resistances R. Using Matlab™ to compute the inverse, we obtain

$$[R]^{-1} = \begin{bmatrix} 0.88 & 0.32 & 0.16 \\ 0.64 & 0.96 & 0.48 \\ -0.16 & 1.76 & 2.88 \end{bmatrix}$$

$$\begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = [R]^{-1} \begin{bmatrix} v_1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.88 & 0.32 & 0.16 \\ 0.64 & 0.96 & 0.48 \\ -0.16 & 1.76 & 2.88 \end{bmatrix} \begin{bmatrix} v_1 \\ 0 \\ 0 \end{bmatrix}$$

and therefore

$$i_1 = 0.88v_1$$
$$i_2 = 0.32v_1$$
$$i_3 = 0.16v_1$$

$i_2 = 0.32\ v_1$
$i_3 = 0.16\ v_1$
should be replaced by
$i_2 = 0.64\ v_1$
$i_3 = \text{-}0.16\ v_1$

Observing that $v_2 = R_5 i_3$, we can compute the desired answer:

$$v_2 = R_5 i_3 = R_5(0.16v_1) = 0.25(0.16v_1)$$

$$A_v = \frac{v_2}{v_1} = \frac{0.04v_1}{v_1} = 0.04$$

$v_2 = R_5 i_3 = R_5(0.16v_1) = 0.25(0.16v_1)$

$A_v = \frac{v_2}{v_1} = \frac{0.04v_1}{v_1} = 0.04$

should be replaced by

$v_2 = R_5 i_3 = R_5(-0.16v_1) = 0.25(-0.16v_1)$

$A_v = \frac{v_2}{v_1} = \frac{-0.04v_1}{v_1} = -0.04$

Comments: The Matlab™ commands required to obtain the inverse of matrix R are listed below.

```
R=[1.5 -0.5 0; -1.5 2 -0.25; 1 -1.25 0.5];
Rinv=inv(R);
```

The presence of a dependent source did not really affect the solution method. Systematic application of mesh analysis provided the desired answer. Is mesh analysis the most efficient solution method? *Hint:* See the exercise below.

CHECK YOUR UNDERSTANDING

Determine the number of independent equations required to solve the circuit of Example 3.13 using node analysis. Which method would you use?

The current source i_x is related to the voltage v_x in the figure on the left by the relation

$$i_x = \frac{v_x}{3}$$

Find the voltage across the 8-Ω resistor by node analysis.