EKEH UCHENNA FRANCIS

15/ENG01/004

CHEMICAL ENGINEERING

ENG 382

SOLUTION

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2 & -1 & 1 & 2 & 1 & -3 \\ 1 & 3 & -3 & 1 & 2 & 1 \\ 5 & 2 & -1 & -1 & 2 & 1 \\ -3 & -1 & 2 & 3 & 1 & 3 \\ 4 & 3 & 1 & -6 & -3 & -2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 20 \\ -15 \\ -3 \\ 16 \\ -27 \end{bmatrix}$$

$$\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & -4 \\ \left(2-\left(\frac{2}{1}\right)\times 1\right) & \left(-1-\left(\frac{2}{1}\right)\times 1\right) & \left(1-\left(\frac{2}{1}\right)\times -2\right) & \left(2-\left(\frac{2}{1}\right)\times 1\right) & \left(1-\left(\frac{2}{1}\right)\times 3\right) & \left(-3-\left(\frac{3}{1}\right)\times -1\right) & 20-\left(\frac{2}{1}\right)\times 4 \\ \left(1-\left(\frac{1}{1}\right)\times 1\right) & \left(3-\left(\frac{1}{1}\right)\times 1\right) & \left(-3-\left(\frac{1}{1}\right)\times 2\right) & \left(-1-\left(\frac{1}{1}\right)\times 1\right) & \left(2-\left(\frac{1}{1}\right)\times 3\right) & \left(1-\left(\frac{1}{1}\right)\times -1\right) & -15-\left(\frac{1}{1}\right)\times 4 \\ \left(5-\left(\frac{5}{1}\right)\times 1\right) & \left(2-\left(\frac{5}{1}\right)\times 1\right) & \left(-1-\left(\frac{5}{1}\right)\times 2\right) & \left(-1-\left(\frac{5}{1}\right)\times 1\right) & \left(2-\left(\frac{5}{1}\right)\times 3\right) & \left(1-\left(\frac{5}{1}\right)\times 1\right) & -3-\left(\frac{5}{1}\right)\times 4 \\ \left(-3-\left(\frac{-3}{1}\right)\times 1\right) & \left(-1-\left(\frac{-3}{1}\right)\times 1\right) & \left(2-\left(\frac{-3}{1}\right)\times 2\right) & \left(3-\left(\frac{-3}{1}\right)\times 1\right) & \left(1-\left(\frac{-3}{1}\right)\times 3\right) & \left(3-\left(\frac{-3}{1}\right)\times 1\right) & 16-\left(\frac{-1}{1}\right)\times 4 \\ \left(4-\left(\frac{4}{1}\right)\times 1\right) & \left(3-\left(\frac{4}{1}\right)\times 1\right) & \left(1-\left(\frac{4}{1}\right)\times 2\right) & \left(-6-\left(\frac{4}{1}\right)\times 1\right) & \left(-3-\left(\frac{4}{1}\right)\times 3\right) & \left(-2-\left(\frac{4}{1}\right)\times -3\right) & -27-\left(\frac{4}{1}\right)\times 4 \end{array}$$

$$= \left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ 0 & -3 & 9 & -6 & -13 & 6 & -23 \\ 0 & 2 & -4 & 6 & 10 & 0 & 28 \\ 0 & -1 & 9 & -10 & -15 & 2 & -43 \end{array}\right]$$

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$$
= \left[\begin{array}{cccccc|c}
1 & 1 & -2 & 1 & 3 & -1 & 4 \\
0 & -3 & 5 & 0 & -5 & -1 & 12 \\
0 & \left(2-\left(\frac{2}{3}\right)\times -3\right) & \left(-1-\left(\frac{2}{3}\right)\times 5\right) & \left(-2-\left(\frac{-2}{3}\right)\times -1\right) & \left(-1-\left(\frac{2}{3}\right)\times 5\right) & \left(2-\left(\frac{-2}{3}\right)\times -1\right) & -14-\left(\frac{-2}{3}\right)\times 12 \\
0 & \left(3-\left(\frac{-3}{3}\right)\times -3\right) & \left(9-\left(\frac{3}{3}\right)\times 5\right) & \left(-6-\left(\frac{3}{3}\right)\times -1\right) & \left(-13-\left(\frac{3}{3}\right)\times -5\right) & \left(6-\left(\frac{3}{3}\right)\times -1\right) & -25-\left(\frac{3}{3}\right)\times 12 \\
0 & \left(2-\left(\frac{2}{3}\right)\times 3\right) & \left(-4-\left(\frac{2}{3}\right)\times 5\right) & \left(6-\left(\frac{2}{3}\right)\times 1\right) & \left(10-\left(\frac{-2}{3}\right)\times 5\right) & \left(8-\left(\frac{-2}{3}\right)\times -1\right) & 28-\left(\frac{-2}{3}\right)\times 12 \\
0 & \left(-1-\left(\frac{1}{3}\right)\times -3\right) & \left(9-\left(\frac{-1}{3}\right)\times 5\right) & \left(-10-\left(\frac{1}{3}\right)\times 1\right) & \left(-15-\left(\frac{-1}{3}\right)\times 5\right) & \left(2-\left(\frac{-1}{3}\right)\times 1\right) & -43-\left(\frac{-1}{3}\right)\times 12
\end{array}\right]
$$

$$
= \left[\begin{array}{cccccc|c}
1 & 1 & -2 & 1 & 3 & -1 & 4 \\
0 & -3 & 5 & 0 & -5 & -1 & 12 \\
0 & 0 & 2.33 & -2 & -4.33 & 1.33 & -11 \\
0 & 0 & 4 & -6 & -8 & 7 & -35 \\
0 & 0 & -0.67 & 6 & 6.667 & -0.67 & 36 \\
0 & 0 & 7.33 & 10 & -13.33 & 2.33 & -47
\end{array}\right]
$$

$$
= \left[\begin{array}{cccccc|c}
1 & 1 & -2 & 1 & 3 & -1 & 4 \\
0 & -3 & 5 & 0 & -5 & -1 & 12 \\
0 & 0 & 2.33 & -2 & -4.33 & 1.33 & -11 \\
0 & 0 & \left(4-\left(\frac{4}{2.33}\right)\times 2.33\right) & \left(-6-\left(\frac{4}{2.33}\right)\times -2\right) & \left(-8-\left(\frac{4}{2.33}\right)\times -4.33\right) & \left(7-\left(\frac{4}{2.33}\right)\times 1.33\right) & -35-\left(\frac{4}{2.33}\right)-11 \\
0 & 0 & \left(-0.67-\left(\frac{-0.67}{2.33}\right)\times 2.33\right) & \left(6-\left(\frac{-0.67}{2.33}\right)\times 2\right) & \left(6\times\left(\frac{-0.67}{2.33}\right)\times -4.33\right) & \left(-0.67-\left(\frac{-0.67}{2.33}\right)\times 1.33\right) & 36-\left(\frac{0.67}{2.33}\right)-11 \\
0 & 0 & \left(7.33-\left(\frac{7.33}{2.33}\right)\times 2.33\right) & \left(-10-\left(\frac{7.3}{2.33}\right)\times -2\right) & \left(-13.3-\left(\frac{7.33}{2.33}\times -2\right)\right) & \left(2.32\times\frac{7.33}{2.33}\times 1.3\right) & -47-\left(\frac{7.33}{2.33}\right)-11
\end{array}\right]
$$

$$
= \left[\begin{array}{cccccc|c}
1 & 1 & -2 & 1 & 3 & -1 & 4 \\
0 & -3 & 5 & 0 & -5 & -1 & 12 \\
0 & 0 & 2.33 & -2 & -4.33 & 1.33 & -11 \\
0 & 0 & 0 & -2.57 & -0.57 & 4.31 & -16.14 \\
0 & 0 & 0 & 5.42 & 5.42 & -0.26 & 32.85 \\
0 & 0 & 0 & -3.11 & 0.26 & -1.85 & -12.43
\end{array}\right]
$$

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$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 2.33 & -2 & -4.33 & 1.33 & -11 \\ 0 & 0 & 0 & -2.57 & -6.57 & 4.71 & -16.14 \\ 0 & 0 & 0 & 0 & 4.22 & 9.67 & -1.22 \\ 0 & 0 & 0 & 0 & 1.11 & -8.67 & 10.89 \end{array}\right]$$

$$= \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.33 & -2 & 4.33 & 1.33 \\ 0 & 0 & 0 & 7.57 & -0.57 & 4.71 \\ 0 & 0 & 0 & 0 & 4.22 & 9.87 \\ 0 & 0 & 0 & 0 & 0 & -11.21 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -16.14 \\ -1.22 \\ 11.21 \end{bmatrix}$$

$$-11.21 \times T_6 = 11.21$$

$$T_6 = -1$$

$$4.22 T_5 + 9.67 T_2 = -1.22$$

$$4.22 T_3 + 9.67(-1) = -1.22$$

$$T_5 = -1.22 + 9.67$$

$$= 4.22$$

$$-2.57 T_4 = -16.14 + 0.57(2) + 4.71(-1)$$

$$T_4 = -16.14 + 0.57(2) + 4.71$$

$$= -2.57$$

$$T_4 = 4$$

$$2.33 T_3 - 2T_4 - 4.33 T_5 + 1.33 T_6 \times -11$$

$$2.33 T_3 = -11 + 2T_4 + 4.33 T_5 - 1.33 T_6$$

$$T_3 = -11 + 2(4) + 4.33(3) - 1.33(-1)$$

$$T_3 = 3$$

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$$-3I_2 + 5I_3 + 0I_4 - 5I_5 - 1I_6 = 12$$

$$I_2 = 12 - 5I_3 - 5I_3 - I_6$$

$$= -3$$

$$I_2 = 12 - 5(3) - 5(2) - (-1) = -3$$

$$I_2 = -2$$

$$= I_1 + I_2 - 2I_3 + I_4 + 3I_5 - I_6 = 4$$

$$I_1 = 4 - I_2 - 2I_3 - I_4 - 3I_5 + I_6$$

$$I_1 = 4 - (-2) + 2(3) - 4 - 3(2) + (-1)$$

$$= 4 + 2 + 6 - 4 - 6 - 1$$

$$= 1$$

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \\ I_6 \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \\ 3 \\ 4 \\ 2 \\ 1 \end{bmatrix}$$

$I_1 = 1$, $I_2 = -2$, $I_3 = 3$, $I_4 = 4$, $I_5 = 2$, $I_6 = 1$

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