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Mechanical Engineering

ENG382

$$T_1 + T_2 - 2T_3 + T_4 + 3T_5 - T_6 = 4$$

$$2T_1 - T_2 + T_3 + 2T_4 + T_5 - 3T_6 = 20$$

$$T_1 + 3T_2 - 3T_3 - T_4 + 2T_5 + T_6 = -15$$

$$5T_1 + 2T_2 - T_3 - T_4 + 2T_5 + T_6 = -3$$

$$-3T_1 - T_2 + 2T_3 + 3T_4 + T_5 + 3T_6 = 16$$

$$4T_1 + 3T_2 + T_3 - 6T_4 - 3T_5 - 2T_6 = -27$$

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

$$\begin{array}{l} 2 - \frac{2}{1} \times 1 \quad -1 - \frac{2}{1} \times 1 \quad 1 - \frac{2}{1} \times (-2) \quad 2 - \frac{2}{1} \times 1 \quad 1 - \frac{2}{1} \times 3 \quad -3 - \frac{2}{1} \times (-1) \quad 20 - \frac{2}{1} \times 4 \\ 1 - \frac{1}{1} \times 1 \quad 3 - \frac{1}{1} \times 1 \quad -3 - \frac{1}{1} \times (-2) \quad -1 - \frac{1}{1} \times 1 \quad 2 - \frac{1}{1} \times 3 \quad 1 - \frac{1}{1} \times (-1) \quad -15 - \frac{1}{1} \times 4 \\ 5 - \frac{5}{1} \times 1 \quad 2 - \frac{5}{1} \times 1 \quad -1 - \frac{5}{1} \times (-2) \quad -1 - \frac{5}{1} \times 1 \quad 2 - \frac{5}{1} \times 3 \quad 1 - \frac{5}{1} \times (-1) \quad -3 - \frac{5}{1} \times 4 \\ -3 - \frac{(-3)}{1} \times 1 \quad -1 - \frac{(-3)}{1} \times 1 \quad 3 - \frac{(-3)}{1} \times (-2) \quad 3 - \frac{(-3)}{1} \times 1 \quad 1 - \frac{(-3)}{1} \times 3 \quad 3 - \frac{(-3)}{1} \times (-1) \quad 16 - \frac{(-3)}{1} \times 4 \\ 4 - \frac{4}{1} \times 1 \quad 3 - \frac{4}{1} \times 1 \quad 1 - \frac{4}{1} \times (-2) \quad -6 - \frac{4}{1} \times 1 \quad -3 - \frac{4}{1} \times 3 \quad -2 - \frac{4}{1} \times (-1) \quad -27 - \frac{4}{1} \times 4 \end{array}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2 & -1 & -2 & -1 & 2 \\ 0 & -3 & 9 & -6 & -13 & 6 \\ 0 & -2 & -4 & 6 & 10 & 0 \\ 0 & -1 & 9 & -10 & -15 & 2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -19 \\ -23 \\ 28 \\ 43 \end{bmatrix}$$

$$\begin{array}{cccccc|c}
 1 & 1 & 2 & 1 & 3 & -1 & 4 \\
 0 & -3 & 5 & 0 & -5 & -1 & 12 \\
 0 & 2 - \frac{2}{3}(-3) & -1 - \frac{2}{3}(-3) & -2 - \frac{2}{3}(0) & -1 - \frac{2}{3}(-5) & 2 - \frac{2}{3}(-1) & -19 - \frac{2}{3}(12) \\
 0 & -3 - \frac{(-3)(-3)}{-3} & 9 - \frac{(-3)(-3)}{-3} & -6 - \frac{(-3)(0)}{-3} & -13 - \frac{(-3)(-5)}{-3} & 6 - \frac{(-3)(-1)}{-3} & -23 - \frac{(-3)(12)}{-3} \\
 0 & 2 - \frac{2}{3}(-3) & -4 - \frac{2}{3}(-3) & 6 - \frac{2}{3}(0) & 10 - \frac{2}{3}(-5) & 0 - \frac{2}{3}(-1) & 28 - \frac{2}{3}(12) \\
 0 & -1 - \frac{(-1)}{3}(-3) & 9 - \frac{(-1)(-3)}{3} & -10 - \frac{2}{3}(0) & -15 - \frac{2}{3}(-5) & 2 - \frac{2}{3}(-1) & -43 - \frac{2}{3}(12)
 \end{array}$$

$$\begin{array}{cccccc|c}
 1 & 1 & -2 & 1 & 3 & -1 & 4 \\
 0 & -3 & 5 & 0 & -5 & -1 & 12 \\
 0 & 0 & \frac{7}{3} & 2 & -\frac{13}{3} & \frac{4}{3} & -11 \\
 0 & 0 & 4 & -6 & -8 & 7 & 35 \\
 0 & 0 & -\frac{2}{3} & 6 & \frac{20}{3} & -\frac{2}{3} & 36 \\
 0 & 0 & -\frac{22}{3} & -10 & -\frac{40}{3} & \frac{7}{3} & -47
 \end{array}$$

$$\begin{array}{cccccc|c}
 1 & 1 & -2 & 1 & 3 & -1 & 4 \\
 0 & -3 & 5 & 0 & 5 & -1 & 12 \\
 0 & 0 & \frac{7}{3} & -2 & -4.33 & 1.33 & -11 \\
 0 & 0 & 4 - \frac{4}{2.333} & -6 - \frac{4}{2.33}(-2) & -8 - \frac{4}{2.3}(4.3) & 7 - \frac{4}{2.3}(1.33) & 35 \\
 0 & 0 & -\frac{2}{3} - \frac{2.3}{7.3} & 6 - \frac{(-0.667)}{2.33}(-2) & 6 - \frac{(-0.667)}{2.33}(-4.33) & -0.667 - \frac{(-0.667)}{2.33}(1.33) & 36 \\
 0 & 0 & 7.3 - \frac{7.3}{2.3}(2.3) & -10 - \frac{7.33}{2.33}(-2) & -13.33 - \frac{7.33}{2.33}(-4.33) & 2.333 - \frac{(7.33)}{2.33}(1.33) & -47
 \end{array}$$

$$\begin{array}{l}
 4 \\
 12 \\
 -11 \\
 -35 - \frac{4}{2.3}(-11) \\
 36 - \frac{(-0.667)}{2.3}(-11) \\
 2.3 \\
 -47 - \frac{(7.3)}{2.33}(-11)
 \end{array}$$

$$\left[\begin{array}{cccccc|c}
 1 & 1 & -2 & 1 & 3 & -1 & 4 \\
 0 & -3 & 5 & 0 & -5 & -1 & 12 \\
 0 & 0 & 2.333 & -2 & -4.33 & 1.333 & -11 \\
 0 & 0 & 0 & -2.571 & -0.571 & 4.714 & -16.142 \\
 0 & 0 & 0 & 5.428 & 5.428 & -0.285 & 32.857 \\
 0 & 0 & 0 & -3.714 & 0.285 & -1.857 & -12.428
 \end{array} \right]$$

$$\begin{array}{ccccccc}
 1 & 1 & -2 & 1 & 3 & -1 & \\
 0 & -3 & 5 & 0 & -5 & -1 & \\
 0 & 0 & 2.33 & -2 & -4.33 & 1.33 & \\
 0 & 0 & 0 & -2.571 & -0.571 & 4.714 & \\
 0 & 0 & 0 & 5.43 - \frac{5.43(-2.571)}{-2.571} & 5.428 - \frac{5.43(-0.571)}{-2.571} & -0.285 - \frac{5.428(4.714)}{-2.571} & \\
 0 & 0 & 0 & -3.71 - \frac{(-3.71)(-2.571)}{-2.571} & 0.285 - \frac{(-3.71)(-0.571)}{-2.571} & -1.857 - \frac{(-3.71)(4.714)}{-2.571} &
 \end{array}$$

$$\begin{array}{l}
 1 \quad 4 \\
 1 \quad 12 \\
 1 \quad -11 \\
 1 \quad -16.142 \\
 1 \quad 32.857 - \frac{5.428(-16.142)}{-2.571} \\
 1 \quad -12.428 - \frac{(-3.71)(4.714)}{-2.571}
 \end{array}$$

$$\begin{array}{ccccccc}
 1 & 1 & -2 & 1 & 3 & -1 & 4 \\
 0 & -3 & 5 & 0 & -5 & -1 & 12 \\
 0 & 0 & 2.333 & -2 & -4.33 & 1.33 & -11 \\
 0 & 0 & 0 & -2.571 & -0.571 & 4.714 & -16.142 \\
 0 & 0 & 0 & 0 & 4.22 & 9.667 & -1.222 \\
 0 & 0 & 0 & 0 & 1.11 & -8.667 & 10.889
 \end{array}$$

$$\begin{array}{ccccccc}
 1 & 1 & -2 & 1 & 3 & -1 & 4 \\
 0 & -3 & 5 & 0 & -5 & -1 & 12 \\
 0 & 0 & 2.333 & -2 & -4.33 & 1.33 & -11 \\
 0 & 0 & 0 & -2.571 & -0.571 & 4.714 & -16.142 \\
 0 & 0 & 0 & 0 & 4.22 & 9.667 & -1.222 \\
 0 & 0 & 0 & 0 & 1.11 - \frac{1.11(4.22)}{4.22} & -8.667 - \frac{1.11(9.667)}{4.22} & 10.889 - \frac{1.11(-1.222)}{4.22}
 \end{array}$$

$$\begin{array}{cccccc|c|c}
 1 & 1 & -2 & 1 & 3 & -1 & \bar{T}_1 & 4 \\
 0 & -3 & 5 & 0 & -5 & -1 & \bar{T}_2 & 12 \\
 0 & 0 & 2.33 & -2 & -4.33 & 1.33 & \bar{T}_3 & -11 \\
 0 & 0 & 0 & -2.571 & -0.571 & 4.714 & \bar{T}_4 & -16.142 \\
 0 & 0 & 0 & 0 & 4.22 & 9.667 & \bar{T}_5 & -1.222 \\
 0 & 0 & 0 & 0 & 0 & -11.21 & \bar{T}_6 & 11.210
 \end{array}$$

$$\bar{T}_6 = \frac{11.210}{-11.210} = -1$$

$$\bar{T}_5 = \frac{(1.222 - 9.667 \times \bar{T}_6)}{4.222} = \frac{1.222 - 9.667 \times (-1)}{4.222} = 2$$

$$\bar{T}_4 = \frac{(-16.142 + 0.571 \times \bar{T}_5 + 4.714 \times \bar{T}_6)}{-2.571} = \frac{-16.142 + 0.571 \times 2 + 4.714 \times (-1)}{-2.571}$$

$$\bar{T}_4 = 4$$

$$\bar{T}_3 = \frac{(-11 + 2 \times \bar{T}_4 + 4.333 \times \bar{T}_5 - 1.333 \times \bar{T}_6)}{2.333} = \frac{-11 + 2 \times 4 + 4.333 \times 2 - 1.333 \times (-1)}{2.333}$$

$$\bar{T}_3 = 3$$

$$\bar{T}_2 = \frac{12 - 5 \times \bar{T}_3 - 0 \times \bar{T}_4 + 5 \times \bar{T}_5 + 1 \times \bar{T}_6}{-3} = \frac{12 - 5 \times 3 - 0 \times 4 + 5 \times 2 + 1 \times (-1)}{-3}$$

$$\bar{T}_2 = -2$$

$$\bar{T}_1 = \frac{4 - 1 \times \bar{T}_2 + 2 \times \bar{T}_3 - 1 \times \bar{T}_4 - 3 \times \bar{T}_5 + 1 \times \bar{T}_6}{-1} = \frac{4 - 1 \times (-2) + 2 \times 3 - 1 \times 4 - 3 \times 2 + 1 \times (-1)}{-1}$$

$$\bar{T}_1 = -1$$

$$\bar{T}_1 = 1$$

$$\bar{T}_2 = -2$$

$$\bar{T}_3 = 3$$

$$\bar{T}_4 = 4$$

$$\bar{T}_5 = 2$$

$$\bar{T}_6 = -1$$