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 Mechanics Engineering
 Assignment 3

$$\begin{aligned} \bar{T}_1 + \bar{T}_2 - 2\bar{T}_3 + \bar{T}_4 + 3\bar{T}_5 - \bar{T}_6 &= 4 \\ 2\bar{T}_1 + \bar{T}_2 + \bar{T}_3 + 2\bar{T}_4 + \bar{T}_5 - 3\bar{T}_6 &= 20 \\ \bar{T}_1 + 3\bar{T}_2 - 3\bar{T}_3 - \bar{T}_4 + 2\bar{T}_5 + \bar{T}_6 &= -15 \\ 5\bar{T}_1 + 2\bar{T}_2 - \bar{T}_3 - \bar{T}_4 + 2\bar{T}_5 + \bar{T}_6 &= -3 \\ -3\bar{T}_1 - \bar{T}_2 + 2\bar{T}_3 + 3\bar{T}_4 + \bar{T}_5 + 3\bar{T}_6 &= 16 \\ 4\bar{T}_1 + 3\bar{T}_2 + \bar{T}_3 - 6\bar{T}_4 - 3\bar{T}_5 - 2\bar{T}_6 &= -27 \end{aligned}$$

Soln

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2 & -1 & 1 & 2 & 1 & -3 \\ 1 & 3 & -3 & -1 & 2 & 1 \\ 5 & 2 & -1 & -1 & 2 & 1 \\ -3 & -1 & 2 & 3 & 1 & 3 \\ 4 & 3 & 1 & 6 & -3 & 2 \end{bmatrix} \begin{bmatrix} \bar{T}_1 \\ \bar{T}_2 \\ \bar{T}_3 \\ \bar{T}_4 \\ \bar{T}_5 \\ \bar{T}_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 20 \\ -15 \\ -3 \\ 16 \\ -27 \end{bmatrix}$$

$$\bar{T}_1 = 2$$

$$\bar{T}_2 = 1$$

$$\bar{T}_3 = 5$$

$$\bar{T}_4 = -3$$

$$\bar{T}_5 = 4$$

$$\begin{bmatrix} 1 & -2 & 1 & -3 & -1 \\ 2-2(1) & -1-2(1) & 1-2(5) & 2-2(-3) & 1-2(4) \\ 1-1(1) & 3-1(1) & -3-1(5) & -1-1(-3) & 2-1(4) \\ 5-5(1) & 2-5(1) & -1-5(5) & 1-5(-3) & 1-5(4) \\ -3+3(1) & -1+3(1) & 2+3(5) & 3+3(-3) & 1+3(4) \\ 4-4(1) & 3-4(1) & 1-4(-2) & -6-4(-3) & -3-4(4) \end{bmatrix} \begin{bmatrix} \bar{T}_1 \\ \bar{T}_2 \\ \bar{T}_3 \\ \bar{T}_4 \\ \bar{T}_5 \\ \bar{T}_6 \end{bmatrix}$$

$$\begin{bmatrix} 20-2(4) \\ -15-1(4) \\ -3-5(4) \\ 16+3(4) \\ -27+4(4) \end{bmatrix}$$

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

$$T_1 = -\frac{1}{3}$$

$$T_2 = -1$$

$$T_3 = -\frac{2}{3}$$

$$T_4 = \frac{1}{3}$$

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

$$= \begin{bmatrix} 4 \\ 12 \\ -19 - \frac{2}{3}(12) \\ -23 - 1(12) \\ 28 + \frac{2}{3}(12) \\ -43 - \frac{1}{3}(12) \end{bmatrix}$$

$$F_1 = \frac{2}{17}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 0 & -4/7 & -4/7 & 33/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 \\ 0 & 0 & 0 & 0 & 10/9 - 5/9(7/3) & -26/3 - 5/9(27/3) \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \bar{T}_1 \\ \bar{T}_2 \\ \bar{T}_3 \\ \bar{T}_4 \\ \bar{T}_5 \\ \bar{T}_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -113/7 \\ -11/9 \\ 88/9 - 5/9(7/3) \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 \\ 0 & 0 & 0 & 0 & 0 & -213/17 \end{bmatrix} \begin{bmatrix} \bar{T}_1 \\ \bar{T}_2 \\ \bar{T}_3 \\ \bar{T}_4 \\ \bar{T}_5 \\ \bar{T}_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -113/7 \\ -11/9 \\ 213/17 \end{bmatrix}$$

$$-\frac{213}{17} \bar{T}_6 = \frac{213}{17}$$

$$\bar{T}_6 = \frac{213}{17} \times \frac{-17}{213} = -1$$

$$\frac{38}{9} \bar{T}_5 + \frac{29}{3} \bar{T}_6 = -\frac{11}{9}$$

$$\bar{T}_5 = \left(-\frac{11}{9} + \frac{29}{3} \right) \times \frac{9}{38}$$

$$\bar{T}_4 = \left(-\frac{113}{7} + \frac{8}{7} + \frac{33}{7} \right) \times \frac{-1}{18} = -2$$

$$\bar{T}_3 = \left(-11 + 8 + \frac{26}{3} + \frac{4}{3} \right) \times \frac{3}{7} = 3$$

$$\bar{T}_2 = \frac{12 - 15 + 10 - 1}{-3} = -2$$

$$\bar{T}_1 = 4 + 2 + 6 - 4 - 6 - 1$$

$$\bar{T}_1 = 1, \quad \bar{T}_2 = -2, \quad \bar{T}_3 = 3, \quad \bar{T}_4 = -4, \quad \bar{T}_5 = 2, \quad \bar{T}_6 = -1$$