

ENG 382

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Elect 1/Elect

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

Solution

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

Using 2 to multiply row 1 & subtract ~~from~~ Row 2

$$2 - (2)(1) = 0$$

$$-1 - (2)(1) = -3$$

$$1 - (2)(-2) = 5$$

$$2 - (2)(1) = 0$$

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

$$-3 - (2)(-1) = -1$$

$$20 - (2)(4) = 12$$

Using a factor of 1 to multiply row 1 & subtract row 3

$$1 - (1)(1) = 0$$

$$2 - (1)(3) = -1$$

$$3 - (1)(1) = 2$$

$$1 - (1)(-1) = 2$$

$$-3 - (1)(-2) = -1$$

$$-15 - (1)(4) = -19$$

$$-1 - (1)(1) = -2$$

Using 5 to multiply row 5 & subtract row 4

$$\begin{aligned} 5 - (5)(1) &= 0 & -1 - (5)(2) &= 9 & 2 - (5)(3) &= -13 & -3 - (5)(4) &= -23 \\ 2 - (5)(1) &= -3 & -1 - (5)(2) &= -6 & 1 - (5)(3) &= 6 \end{aligned}$$

Using -3 to multiply row 1 & subtract row 5

$$\begin{aligned} -3 - (-3)(1) &= 0 & 2 - (-3)(2) &= -4 & 1 - (-3)(3) &= 10 & 16 - (-3)(4) &= 28 \\ -1 - (-3)(1) &= 2 & 3 - (-3)(1) &= 6 & 3 - (-3)(-1) &= 0 \end{aligned}$$

Using a factor of 4 to multiply Row 1 subtract Row 6

$$\begin{aligned} 4 - (4)(1) &= 0 & 1 - (4)(-2) &= 9 & -3 - (4)(3) &= -15 & -27 - (4)(4) &= -43 \\ 3 - (4)(1) &= -1 & -6 - (4)(1) &= -10 & -2 - (4)(-1) &= 2 \end{aligned}$$

The matrix becomes

$$\begin{pmatrix} 1 & 1 & -2 & 1 & 8 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2 & -1 & -2 & -1 & 2 \\ 0 & -3 & 9 & -6 & -13 & 6 \\ 0 & 2 & -4 & 6 & 16 & 0 \\ 0 & -1 & 9 & -10 & -15 & 2 \end{pmatrix} \begin{pmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{pmatrix} = \begin{pmatrix} 4 \\ 12 \\ -19 \\ -23 \\ 28 \\ -43 \end{pmatrix}$$

Using $-\frac{2}{3}$ to multiply row 2 & subtract from row

Using 1 to multiply row 2 and subtract row 4

Using $-\frac{2}{3}$ to multiply row 2 and subtract row 5

Using $\frac{1}{3}$ to multiply row 2 & subtract row 2

The matrix becomes

$$\begin{pmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.3333 & -2 & -4.333 & 1.333 \\ 0 & 0 & 4 & -6 & -8 & 7 \\ 0 & 0 & -0.6666 & 6 & 6.666 & -0.666 \\ 0 & 0 & 7.3333 & -10 & -13.333 & 2.333 \end{pmatrix} \begin{pmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{pmatrix} = \begin{pmatrix} 4 \\ 12 \\ -11 \\ -35 \\ 36 \\ -47 \end{pmatrix}$$

Using 0.2856 to multiply row 3 & subtract row 5

Using $\frac{2.333}{2.333}$ to multiply row 2 & subtract row 6

The new matrix becomes

$$\begin{pmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.333 & -2 & -4.333 & 1.333 \\ 0 & 0 & 0 & -2.571 & -8.3714 & 4.7142 \\ 0 & 0 & 0 & 5.428 & 5.428 & -0.2857 \\ 0 & 0 & 0 & -3.714 & 6.2857 & -1.8571 \end{pmatrix} \begin{pmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{pmatrix} = \begin{pmatrix} 4 \\ 12 \\ -11 \\ -16.142 \\ 32.857 \\ -12.428 \end{pmatrix}$$

Using $\frac{5.428}{-2.571}$ to multiply row 4 and subtract from row 5
 using $\frac{-3.714}{-2.571}$ to multiply row 5 & divide row 6

The matrix becomes

$$\begin{pmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.333 & -2 & -4.333 & 1.333 \\ 0 & 0 & 0 & -2.5714 & -8.3714 & 4.7142 \\ 0 & 0 & 0 & 0 & 4.222 & 9.666 \\ 0 & 0 & 0 & 0 & 1.111 & -8.666 \end{pmatrix} \begin{pmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{pmatrix} = \begin{pmatrix} 4 \\ 12 \\ -11 \\ -16.142 \\ -1.222 \\ 10.888 \end{pmatrix}$$

Using $(\frac{1.111}{4.222})$ to multiply row 5 & subtract row 6

The matrix becomes

$$\begin{pmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.333 & -2 & -4.333 & 1.333 \\ 0 & 0 & 0 & -2.5714 & -8.3714 & 4.714 \\ 0 & 0 & 0 & 0 & 4.222 & 9.666 \\ 0 & 0 & 0 & 0 & 0 & -11.2105 \end{pmatrix} \begin{pmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{pmatrix} = \begin{pmatrix} 4 \\ 12 \\ -11 \\ -16.1429 \\ -1.222 \\ 11.2105 \end{pmatrix}$$

Using back substitution

$$\leftarrow -11.2105 T_6 = 11.2105$$

$$T_6 = -1$$

$$4.222 T_5 + 9.666 T_6 = -1.222$$

$$T_5 = \frac{-1.2222 - 9.6666(-1)}{4.2222} = 2$$

$$-2.5714T_4 - 0.5714T_5 + 4.7142T_6 = -16.1429$$

$$T_4 = \frac{-16.1429 + 4.712(-1) + 0.5714 \times 2}{-2.5714} = 4$$

$$2.3333T_3 - 2T_4 - 4.3333T_5 + 1.3333T_6 = -11$$

$$T_3 = \frac{-11 - 1.3333(-1) + 4.3333(2) + 2(4)}{-2.3333} = 3$$

$$-3T_2 + 3T_3 + 6T_4 - 5T_5 - T_6 = 12$$

$$T_2 = \frac{12 + (-1) + 5(2) - 5(3)}{-3} = 2$$

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

$$T_1 = \frac{4 + (-1) - 3(2) - 4 + 2(3) - (-2)}{1} = 1$$

$$\therefore T_1 = 1$$

$$T_2 = -2$$

$$T_3 = 3$$

$$T_4 = 4$$

$$T_5 = 2$$

$$T_6 = -1$$