

ENOMFON BASSEY
 15/ENG03/008
 CIVIL ENGINEERING

1)

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

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

To make $a_{21} = 0$

Row 2 - (a_{21}/a_{11}) Row 1 ; But $a_{21}/a_{11} = 2$

For a_{21} : $2 - (2)1 = 0$

$a_{22} = -1 - (2)1 = -3$

$a_{23} = 1 - (2)(-2) = 5$

$a_{24} = 2 - (2)(1) = 0$

$a_{25} = 1 - (2)3 = -5$

$a_{26} = -3 - (2)(-1) = -1$

$a_{27} = 20 - (2)4 = 12$

To make $a_{31} = 0$

Row 3 - (a_{31}/a_{11}) Row 1 But $a_{31}/a_{11} = 1$

$$\begin{aligned} \text{For } a_{31} &= 1 - (1)1 = 0 \\ a_{32} &= 3 - (1)1 = 2 \\ a_{33} &= -3 - (1)(-2) = -1 \\ a_{34} &= -1 - (1)1 = -2 \\ a_{35} &= 2 - (1)3 = -1 \\ a_{36} &= 1 - (1)(-1) = 2 \\ a_{37} &= 1 - 15 - (1)4 = -19 \end{aligned}$$

To make $a_{41} = 0$

Row 4 - (a_{41}/a_{11}) Row 1 ; But $a_{41}/a_{11} = 5$

$$\begin{aligned} a_{41} &= 5 - (5)1 = 0 \\ a_{42} &= 2 - (5)1 = -3 \\ a_{43} &= 3 - (5)(-2) = 9 \\ a_{44} &= -1 - (5)(1) = -6 \\ a_{45} &= 2 - (5)3 = -13 \\ a_{46} &= 1 - (5)(-1) = 6 \\ a_{47} &= -3 - (5)4 = -23 \end{aligned}$$

To make $a_{51} = 0$

Row 5 - (a_{51}/a_{11}) Row 1 ; But $a_{51}/a_{11} = -3$

$$\begin{aligned} a_{51} &= -3 - (-3)1 = 0 \\ a_{52} &= -1 - (-3)1 = 2 \\ a_{53} &= 2 - (-3)(-2) = -4 \\ a_{54} &= 3 - (-3)1 = 6 \\ a_{55} &= 1 - (-3)3 = 10 \\ a_{56} &= 3 - (-3)(-1) = 0 \\ a_{57} &= 16 - (-3)4 = 28 \end{aligned}$$

To make $a_{61} = 0$

Row 6 - (a_{61}/a_{11}) Row 1 ; But $a_{61}/a_{11} = 1$

$$a_{61} = 4 - (1)1 = 0$$

$$a_{62} = 5 - (4)1 = -1$$

$$a_{63} = 1 - (11)(-3) = 9$$

$$a_{64} = -1 - (4)1 = -5$$

$$a_{65} = -3 - (4)3 = -15$$

$$a_{66} = -3 - (4)(-1) = 2$$

$$a_{67} = -27 - (4)4 = -43$$

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

To make $a_{32} = 0$

Row 3 - (a_{32}/a_{22}) Row 2; But $a_{33}/a_{22} = -2/3$

$$a_{32} = 2 - (-2/3)(-3) = 0$$

$$= -1 - (-2/3)(5) = 7/3$$

$$= -2 - (-2/3)(0) = -2$$

$$= -1 - (-2/3)(-5) = -11/3$$

$$= 2 - (-2/3)(-1) = 4/3$$

$$= -19 - (-2/3)(12) = -11$$

To make $a_{42} = 0$

Row 4 - (a_{42}/a_{22}) Row 2; But $a_{42}/a_{22} = 1$

$$-3 - (1)(-3) = 0$$

$$9 - (1)(9) = 0$$

$$-6 - (1)(0) = -6$$

$$-13 - (1)(-3) = -10$$

$$= 6 - (1)(-1) = 7$$

$$= -23 - (1)12 = -35$$

To make $a_{52} = 0$

Row 5 - (a_{52}/a_{22}) Row 2; But $a_{52}/a_{22} = -2/3$

$$\text{For } a_{52} = 2 - (-2/3)(-3) = 0$$

$$= -4 - (-2/3)(5) = -2/3$$

$$= 6 - (-2/3)(10) = 6$$

$$= 10 - (-2/3)(-5) = 20/3$$

$$= 0 - (-2/3)(-1) = -2/3$$

$$= 28 - (-2/3)12 = 36$$

To make $a_{62} = 0$

Row 6 - (a_{62}/a_{22}) Row 2; But $a_{62}/a_{22} = 1/3$

$$\text{For } a_{62} = -1 - (1/3)(-3) = 0$$

$$= 9 - (1/3)(5) = 22/3$$

$$= -5 - (1/3)0 = -5$$

$$= -15 - (1/3)(-5) = -40/3$$

$$= 2 - (1/3)(-1) = 7/3$$

$$= -43 - (1/3)(12) = -47$$

$$\left[\begin{array}{cccccc|c} 1 & 1 & 2 & 1 & 3 & -11 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 4 & -6 & -8 & 7 & -25 \\ 0 & 0 & -2/3 & 6 & 20/3 & -2/3 & 36 \\ 0 & 0 & 22/3 & -5 & -40/3 & 7/3 & -47 \end{array} \right]$$

To make $a_{43} = 0$
 Row 4 - (a_{43}/a_{33}) Row 3 ; But $a_{43}/a_{33} = 12/7$

For $a_{43} = 4 - (12/7)(7/3) = 0$
 $= -6 - (12/7)(-2) = -4/7$
 $= -8 - (12/7)(-13/3) = 33/7$
 $= 7 - (12/7)(4/3) = -113/7$
 $= -35 - (12/7)(-11) = -113/7$

To make $a_{53} = 0$
 Row 5 - (a_{53}/a_{33}) Row 3 ; But $a_{53}/a_{33} = -2/7$

For $a_{53} = -2/3 - (-2/7)(7/3) = 0$
 $= 6 - (-2/7)(-2) = 38/7$
 $= 25/3 - (-2/7)(-13/3) = 38/7$
 $= -2/3 - (-2/7)(4/3) = -2/7$
 $= 36 - (-2/7)(-11) = 230/7$

To make $a_{63} = 0$
 Row 6 - (a_{63}/a_{33}) Row 3 ; But $a_{63}/a_{33} = 22/7$

For $a_{63} = 22/3 - (22/7)(7/3) = 0$
 $= -5 - (22/7)(-2) = 9/7$
 $= -40/3 - (22/7)(-13/3) = 2/7$
 $= 7/3 - (22/7)(4/3) = -13/7$
 $= -47 - (22/7)(-11) = -87/7$

1	1	-3	1	5	-1	4
0	-3	5	0	-5	-1	12
0	0	7/3	-2	-13/3	-13/3	-11
0	0	0	-18/7	-4/7	-4/7	-113/7
0	0	0	38/7	38/7	38/7	230/7
0	0	0	9/7	2/7	2/7	-87/7

To make $a_{54} = 0$

Row 5 - (a_{54}/a_{44}) Row 4; But $a_{54}/a_{44} = 19/9$

$$\begin{aligned} \text{For } a_{54} &= 38/7 - (-19/9)(-11/7) = 0 \\ &= 38/7 - (-19/9)(-4/7) = 38/9 \\ &= -2/7 - (-19/9)(33/7) = 29/5 \\ &= 280/7 - (-19/9)(-113/7) = -11/9 \end{aligned}$$

To make $a_{64} = 0$

Row 6 - (a_{64}/a_{44}) Row 4; But $a_{64}/a_{44} = -1/2$

$$\begin{aligned} \text{For } a_{64} &= 9/7 - (-1/2)(-18/7) = 0 \\ &= 2/7 - (-1/2)(-4/7) = 0 \\ &= -13/7 - (-1/2)(33/7) = 1/2 \\ &= -87/7 - (-1/2)(-113/7) = -41/2 \end{aligned}$$

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 5 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/5 & -2 & -13/5 & 4/5 & -11 \\ 0 & 0 & 0 & -18/7 & -4/7 & 23/7 & -113/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/5 & -11/9 \\ 0 & 0 & 0 & 0 & 0 & 1/2 & -41/2 \end{array} \right]$$

To make $a_{65} = 0$

Row 6 - (a_{65}/a_{55}) Row 5; But $a_{65}/a_{55} = 0$

$$\begin{aligned} \text{For } a_{65} &= 0 - (0) 38/9 = 0 \\ &= 1/2 - (0) (39/3) = 1/2 \\ &= -41/2 - (0) (-11/4) = -41/2 \end{aligned}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & -1 & 4 \\ 0 & -3 & 5 & 0 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & 4/3 & -11 \\ 0 & 0 & 0 & -16/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 0 & 29/3 & -11/9 \\ 0 & 0 & 0 & 0 & 1/2 & -41/2 \end{bmatrix}$$

$$0T_1 + 0T_2 + 0T_3 + 0T_4 + 0T_5 + 1/2(T_6) = -41/2$$

$$T_6/2 = -41/2$$

$$T_6 = -41$$

$$0T_1 + 0T_2 + 0T_3 + 0T_4 + 38/9 T_5 + 29/6 T_6 = -11/9$$

$$\frac{38T_5}{9} + \frac{29}{6}(-41) = -11/9$$

$$\frac{38T_5}{9} = \frac{3556}{9}$$

$$T_5 = \frac{3556}{38} = 93.5789$$

$$0T_1 + 0T_2 + 0T_3 + (-16/7)T_4 + (-4/9)T_5 + (37/7)T_6 = -113/7$$

$$= \frac{16T_4}{7} - \frac{1016}{19} - \frac{1353}{7} = -\frac{113}{7}$$

$$-\frac{1814}{7} = \frac{30672}{133}$$

$$T_4 = -89.6842$$

$$0T_1 + 0T_2 + (7/3)T_3 + (-2)T_4 + (-13/3)T_5 + (4/3)T_6 = -11$$

$$\frac{7T_3}{3} - \left(2 \times \frac{1704}{19}\right) - \frac{13}{3} \times \frac{3556}{38} + \left(\frac{4}{3} \times -41\right) = -11$$

$$\frac{7}{3}T_3 = -11 - \frac{3408}{19} + \frac{46228}{114} + \frac{164}{3}$$

$$T_3 = \frac{15379}{57} \times 3/7$$

$$T_3 = 115.6818$$

$$0T_1 + (-3)T_2 + (1)T_3 + (0)T_4 + (-5)T_5 + (-1)T_6 = 12$$

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

$$-3T_2 + \left(\frac{5 \times 46137}{399} \right) - \left(\frac{5 \times 3556}{38} \right) - (-41) = 12$$

$$-3T_2 = 12 - 41 - \frac{230685}{399} + \frac{17780}{38}$$

$$T_2 = \frac{-2646}{19} \div -3$$

$$T_2 = 46.434$$

$$T_1 + T_2 + (-2)T_3 + (1)T_4 + (3)T_5 + (-1)T_6 = 4$$

$$T_1 + \frac{882}{19} + \left(\frac{-2 \times 46137}{399} \right) + \left(\frac{-1704}{19} \right) + \left(3 \times \frac{3556}{38} \right) + (-1 \times -41) = 4$$

$$T_1 = 4 - 41 - \frac{882}{19} + \frac{92274}{399} + \frac{1704}{19} - \frac{10668}{8}$$

$$T_1 = -432105$$