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Assignment III

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Dept:- Mechanical Engineering.

Course:- EMG382 Engineering Mathematics

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

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

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

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

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

$$4T_1 + 3T_2 + T_3 - 6T_4 - 3T_5 + 2T_6 = -29$$

Using Gauss elimination method

$$\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 2 & -1 & 1 & 2 & 1 & -3 & 20 \\ 1 & 3 & -3 & -1 & 2 & 1 & -15 \\ 5 & 2 & -1 & -1 & 2 & 1 & -3 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -29 \end{array}$$

$$\text{Pivot} = \frac{a_{21}}{a_{11}} = \frac{2}{1} = 2$$

$$\therefore (2 - (2 \times 1))T_1 + (-1 - (2 \times 1))T_2 + (1 - (2 \times -2))T_3 + (2 - (2 \times 1))T_4 + (1 - (2 \times 3))T_5 + (-3 - (2 \times -1))T_6 = (20 - (2 \times 4))$$

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

$$\text{Pivot} = \frac{a_{31}}{a_{11}} = \frac{1}{1} = 1$$

$$\therefore (1 - (1 \times 1))T_1 + (3 - (1 \times 1))T_2 + (-3 - (1 \times -2))T_3 + (-1 - (1 \times 1))T_4 + (2 - (1 \times 3))T_5 + (1 - (1 \times -1))T_6 = (-15 - (1 \times 4))$$

$$= 0T_1 + 2T_2 - 1T_3 - 2T_4 - 1T_5 + 2T_6 = -11$$

$$\text{Pivot} = \frac{a_{41}}{a_{11}} = \frac{5}{1} = 5$$

$$\therefore (5 - (5 \times 1))T_1 + (2 - (5 \times 1))T_2 + (-1 - (5 \times -2))T_3 + (-1 - (5 \times 1))T_4 + (2 - (5 \times 3))T_5 + (1 - (5 \times -1))T_6 = (-3 - (5 \times 4))$$

$$= 0T_1 - 3T_2 + 9T_3 - 6T_4 - 13T_5 + 6T_6 = -23$$

$$\text{Pivot} = \frac{a_{51}}{a_{11}} = \frac{-3}{1} = -3$$

$$\therefore (-3 - (-3 \times 1))T_1 + (-1 - (-3 \times 1))T_2 + (2 - (-3 \times -2))T_3 + (3 - (-3 \times 1))T_4 + (1 - (-3 \times 3))T_5 + (3 - (-3 \times -1))T_6 = (16 - (-3 \times 4))$$

$$= 0T_1 + 2T_2 - 4T_3 + 6T_4 + 10T_5 + 0T_6 = 28$$

$$\text{Pivot} = \frac{a_{61}}{a_{11}} = \frac{4}{1} = 4$$

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$$(4 - (4 \times 1)) \cdot_1 + (3 - (4 \times 1)) \cdot_2 + (1 - (4 \times 2)) \cdot_3 + (-6 - (4 \times 1)) \cdot_4 + (-3 - (4 \times 3)) \cdot_5 + (-2 - (4 \times 1)) \cdot_6 = (-27 - (4 \times 4))$$

$$= 0 \cdot_1 - 1 \cdot_2 + 9 \cdot_3 - 10 \cdot_4 - 15 \cdot_5 + 2 \cdot_6 = -43$$

a_{11}	1	1	-2	1	3	-1	4
a_{21}	0	-3	5	0	-5	-1	12
a_{31}	0	2	-1	-2	-1	2	-11
a_{41}	0	-3	9	-6	-13	6	-23
a_{51}	0	2	-4	6	10	0	28
a_{61}	0	-1	9	-10	-15	24	-43

$$\text{Pivot} = \frac{a_{32}}{a_{22}} = \frac{2}{-3} = -\frac{2}{3}$$

$$= (0 - (-\frac{2}{3} \times 0)) \tau_1 + (2 - (-\frac{2}{3} \times -3)) \tau_2 + (-1 - (-\frac{2}{3} \times 5)) \tau_3 + (-2 - (-\frac{2}{3} \times 0)) \tau_4 + (-1 - (-\frac{2}{3} \times -5)) \tau_5 + (2 - (-\frac{2}{3} \times -1)) \tau_6 = (-11 - (-\frac{2}{3} \times 2))$$

$$= 0 \tau_1 - 0 \tau_2 + 2.33 \tau_3 - 2 \tau_4 - 4.33 \tau_5 + 1.33 \tau_6 = -9.67$$

$$\text{Pivot} = \frac{a_{42}}{a_{22}} = \frac{-3}{-3} = 1$$

$$= (0 - (1 \times 0)) \tau_1 + (-3 - (1 \times -3)) \tau_2 + (9 - (1 \times 5)) \tau_3 + (-6 - (1 \times 0)) \tau_4 + (-13 - (1 \times -5)) \tau_5 + (6 - (1 \times -1)) \tau_6 = (-23 - (1 \times 12))$$

$$= 0 \tau_1 + 0 \tau_2 + 4 \tau_3 - 6 \tau_4 - 8 \tau_5 + 7 \tau_6 = -35$$

$$\text{Pivot} = \frac{a_{52}}{a_{22}} = \frac{2}{-3} = -\frac{2}{3}$$

$$= (0 - (-\frac{2}{3} \times 0)) \tau_1 + (2 - (-\frac{2}{3} \times -3)) \tau_2 + (-4 - (-\frac{2}{3} \times 5)) \tau_3 + (-6 - (-\frac{2}{3} \times 0)) \tau_4 + (10 - (-\frac{2}{3} \times -5)) \tau_5 + (0 - (-\frac{2}{3} \times -1)) \tau_6 = (28 - (-\frac{2}{3} \times 12))$$

$$\Rightarrow 0 \tau_1 + 0 \tau_2 - 0.33 \tau_3 + 6 \tau_4 + 6.7 \tau_5 + 0.33 \tau_6 = 36$$

$$\text{Pivot} = \frac{a_{62}}{a_{22}} = \frac{-1}{-3} = \frac{1}{3}$$

$$= (0 - (\frac{1}{3} \times 0)) \tau_1 + (-1 - (\frac{1}{3} \times -3)) \tau_2 + (9 - (\frac{1}{3} \times 5)) \tau_3 + (-10 - (\frac{1}{3} \times 0)) \tau_4 + (-15 - (\frac{1}{3} \times -5)) \tau_5 + (2 - (\frac{1}{3} \times -1)) \tau_6 = (-43 - (\frac{1}{3} \times 12))$$

$$= 0 \tau_1 + 0 \tau_2 + 7.33 \tau_3 - 10 \tau_4 - 13.3 \tau_5 + 2.33 \tau_6 = -47$$

	a_1	a_2	a_3	a_4	a_5	a_6	
a_1	1	1	-2	1	3	-1	4
a_2	0	3	5	0	-5	-1	12
a_3	0	0	2.33	-2	-4.33	1.33	-9.67
a_4	0	0	4	-6	-8	7	-35
a_5	0	0	-0.7	6	6.7	-0.7	36
a_6	0	0	7.33	-10	-13.3	2.33	-47

$$\text{Pivot} = \frac{a_{43}}{a_{33}} = \frac{4}{2.33} = 1.72$$

$$\begin{aligned} & (0 - (1.72 \times 0))T_1 + (0 - (1.72 \times 0))T_2 + (4 - (1.72 \times 2.33))T_3 \\ & + (-6 - (1.72 \times -2))T_4 + (-8 - (1.72 \times -4.33))T_5 + (7 - (1.72 \times 1.33))T_6 \\ & = (-35 - (1.72 \times -9.67)) \\ & = 0T_1 + 0T_2 + 0T_3 - 2.56T_4 - 0.6T_5 + 4.7T_6 = -18.4 \end{aligned}$$

$$\text{Pivot} = \frac{a_{53}}{a_{33}} = \frac{-0.7}{2.33} = -0.3$$

$$\begin{aligned} & (0 - (-0.3 \times 0))T_1 + (0 - (-0.3 \times 0))T_2 + (-0.7 - (-0.3 \times 2.33))T_3 \\ & + (6 - (-0.3 \times -2))T_4 + (6.7 - (-0.3 \times -4.33))T_5 + (-0.7 - (-0.3 \times 1.33))T_6 \\ & = 0T_1 + 0T_2 + 0T_3 + 5.4T_4 + 5.4T_5 + 0.3T_6 = 83 \end{aligned}$$

$$\text{Pivot} = \frac{a_{63}}{a_{33}} = \frac{7.33}{2.33} = 3.15$$

$$\begin{aligned} & (0 - (3.15 \times 0))T_1 + (0 - (3.15 \times 0))T_2 + (7.33 - (3.15 \times 2.33))T_3 \\ & + (-10 - (3.15 \times -2))T_4 + (-13.3 - (3.15 \times -4.33))T_5 + (2.33 - (3.15 \times 1.33))T_6 \\ & = (-47 - (3.15 \times -9.67)) \\ & = 0T_1 + 0T_2 + 0T_3 - 3.7T_4 + 0.34T_5 + (-1.9)T_6 = -16.5 \end{aligned}$$

	a_1	a_2	a_3	a_4	a_5	a_6	
a_1	1	1	-2	1	3	-1	4
a_2	0	3	5	0	-5	-1	12
a_3	0	0	2.33	-2	-4.33	1.33	-9.67
a_4	0	0	0	-2.6	-0.6	4.7	-18.4
a_5	0	0	0	5.4	5.4	0.3	83
a_6	0	0	0	-3.7	0.34	-1.9	-16.5

$$\text{Pivot} = \frac{a_{54}}{a_{44}} = \frac{5.4}{-2.6} = -2$$

$$\begin{aligned} & (0 - (-2 \times 0))T_1 + (0 - (-2 \times 0))T_2 + (0 - (-2 \times 0))T_3 + (5.4 - (-2 \times -2.6))T_4 \\ & + (-0.6 - (-2 \times -0.6))T_5 + (4.7 - (-2 \times 4.7))T_6 = (33 - (-2 \times -18.4)) \\ & = 0T_1 + 0T_2 + 0T_3 + 0T_4 + 4.2T_5 + 9.7T_6 = -37.4 \end{aligned}$$

$$\text{Pivot} = \frac{a_{64}}{a_{44}} = \frac{-3.7}{-2.6} = 1.4$$

$$(0 - (1.4 \times 0))T_1 + (0 - (1.4 \times 0))T_2 + (0 - (1.4 \times 0))T_3 + (-3.7 - (1.4 \times 2.6))T_4 + (0.3 - (1.4 \times 0))T_5 + (-1.9 - (1.4 \times 4.7))T_6 = (-16.5 - (1.4 \times -18.4))$$

$$= 0T_1 + 0T_2 + 0T_3 + 0T_4 + 1.16T_5 + 8.59T_6 = 10.7$$

1	1	-2	1	3	-1	4
0	-3	5	0	5	-1	12
0	0	2.4	-2	-4.4	1.4	-11
0	0	0	-2.7	-0.7	4.7	-16.7
0	0	0	0	4.01	9.2	-0.74
0	0	0	0	1.16	-8.59	10.7

$$\text{Pivot} = \frac{a_{65}}{a_{55}} = \frac{1.16}{4.01} = 0.3$$

$$(0 - (0.3 \times 0))T_1 - (0 - (0.3 \times 0))T_2 + (0 - (0.3 \times 0))T_3 + (0 - (0.3 \times 0))T_4 + (1.16 - (0.3 \times 4.01))T_5 + (-8.59 - (0.3 \times 9.2))T_6 + (10.7 - (0.3 \times -0.74))$$

$$= 0T_1 + 0T_2 + 0T_3 + 0T_4 + 0T_5 - 11.4T_6 = 10.9$$

1	1	-2	1	3	-1	4
0	-3	5	0	5	-1	2
0	0	2.4	-2	-4.4	1.4	-11
0	0	0	-2.7	-0.7	4.7	-16.7
0	0	0	0	4.01	9.2	-0.74
0	0	0	0	0	-11.4	10.9

Using back substitution method.

$$-11.4T_6 = 10.9$$

$$T_6 = 10.9 / -11.4$$

$$T_6 = -0.96^\circ\text{C}$$

$$4.01T_5 + 9.2T_6 = -0.74$$

$$4.01T_5 + 9.2(-0.96) = -0.74$$

$$4.01T_5 = 8.092$$

$$T_5 = 2.02^\circ\text{C}$$

$$-2.7T_4 - 0.7T_5 + 4.7T_6 = -16.7$$

$$-2.7T_4 - 0.7(2.0) + 4.7(-0.96) = -16.7$$

$$-2.7T_4 - 1.4 - 4.512 = -16.7$$

$$-2.7T_4 - 5.912 = -16.7$$

$$-2.7T_4 = -16.7 + 5.91$$

$$-2.7T_4 = -10.79$$

$$T_4 = 3.99^\circ\text{C}$$

$$2.4T_3 - 2T_4 - 44T_5 + 1.4T_6 = -11$$

$$2.4T_3 - 2(3.99) - 44(2.012) + 1.4(-0.96) = -11$$

$$T_3 = 3.017^\circ\text{C}$$

$$-3T_2 + 5T_3 + 0T_4 + 5T_5 + 1T_6 = 2$$

$$-3T_2 + 5(3.017) + 0 + 5(2.012) + (-0.96) = 2$$

$$T_2 = -2.034$$

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

$$T_1 + (-2.034) - 2(3.017) + 3.99 + 3(2.012) - (-0.96) = 2$$

$$T_1 = 1.032^\circ\text{C}$$

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